WBG041311142140ATL

Regional Water Plan

June 2017

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Table of Contents

Tables

Figures

AAD-MGD	annual average demand in million gallons per day
AAF-MGD	annual average flow in million gallons per day
ACCG	Association of County Commissioners of Georgia
AG	Agricultural Water Withdrawal (Permittee Category)
BMP	best management practice
BP	balance priorities
CMOM	capacity, management, operation, and maintenance
CR	conservation and reuse capacity
CST	Construction Stormwater (Permittee Category)
DA	data management
DCA	Department of Community Affairs
DCH	Department of Community Health
DNR	Department of Natural Resources
DO	dissolved oxygen
FERC	Federal Energy Regulatory Commission
FOG	fats, oils, and grease
GADNR	Georgia Department of Natural Resources
GAEPD	Georgia Environmental Protection Division of GADNR
GAWP	Georgia Association of Water Professionals
GC	Golf Course Water Withdrawal (Permittee Category)
GEFA	Georgia Environmental Finance Authority
GEMA	Georgia Emergency Management Agency
GGCSA	Georgia Golf Course Superintendents Association
GGIA	Georgia Green Industry Association
GLUT	Georgia Land Use Trends
GMA	Georgia Municipal Association
gpd	gallons per day
gpf	gallons per flush
gpm	gallons per minute
GRWA	Georgia Rural Water Association
GSWCC	Georgia Soil and Water Conservation Commission
GWPPC	Georgia Water Planning & Policy Center
I/I	inflow and infiltration
IND	Industrial Water Withdrawal (Permittee Category)
INDST	Industrial Stormwater (Permittee Category)
INDWW	Industrial Wastewater (Permittee Category)
LAS	land application system
lb/yr	pounds per year
MG	million gallons

MGD	million gallons per day
mg/L	milligrams per liter
µg/L	micrograms per liter
MOA	Memorandum of Agreement
MP	Management Practices
MS4	Municipal Separate Storm Sewer System (Permittee Category)
MU	Municipal Water Withdrawal (Permittee Category)
MUST	Municipal Stormwater (Permittee Category)
MUWW	Municipal Wastewater (Permittee Category)
MWh	megawatt-hour
NARSAL	Natural Resources Spatial Analysis Laboratory
NESPAL	National Environmentally Sound Production Agriculture Laboratory
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
O&M	operation and maintenance
O.C.G.A.	Official Code of Georgia Annotated
OSSM	On-Site Sewage Management System
RC	Regional Commission
RC&D	Resource Conservation and Development
RS	revenue strategies
SD	Safe Dams Program
SSO	Sanitary Sewer Overflow
TMDL	total maximum daily load
µg/L	micrograms per liter
UGA	University of Georgia
USDA	United States Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	Underground Storage Tank (Permittee Category)
WC	water conservation (Management Practice Category)
WCIP	Water Conservation Implementation Plan
WQ	water quality (Management Practice Category)
WRD	Wildlife Resources Division of GADNR
WS	water supply (Management Practice Category)
WTP	water treatment plant
WW	wastewater (Management Practice Category)
WWTP	wastewater treatment plant

Acknowledgements

Georgia Environmental Protection Division (GAEPD) and Jacobs gratefully acknowledge the cooperation, courtesy, and contributions of the following members of the Upper Oconee Regional Water Planning Council. The Council members volunteered their time and talents for Council Meetings, Joint Council Meetings, and countless conference calls during the development of this Regional Water Plan.

Name	City	County
Charles S. Armentrout	Athens-Clarke	Athens-Clarke
Hunter Bicknell	Jefferson	Jackson
Stuart A. Cofer	Bogart	Oconee
Melvin Davis	Watkinsville	Oconee
Jennifer Davis	Dublin	Laurens
Larry J. Eley	White Plains	Greene
Alan Foster	Eatonton	Putnam
Linda S. Gantt	Watkinsville	Oconee
Pat Graham	Braselton	Barrow
Patrick H. Hardy, Sr.	Madison	Morgan
Danny Hogan	Dexter	Laurens
Charles H. Jordan	Sandersville	Washington
Kevin Little	Monroe	Walton
Jim Luke	Bogart	Oconee
W. Rabun Neal	Greensboro	Greene
Bill Ross	Statham	Barrow
Benjamin R. Tarbutton	Sandersville	Washington
Greg Thompson	Monroe	Walton
Representative Terry England		Ex-Officio
Senator Bill Cowsert		Ex-Officio

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Executive Summary

This Regional Water Plan lays out a roadmap for implementing specific measures designed to ensure wise use and management of the Region's water over the next 35 years. It focuses on four areas:

1. Water Conservation—Responsible use of public resources.

2. Water Supply—Optimal management of water supplies and systems.

3. Wastewater—Reliable means for wastewater treatment and reuse.

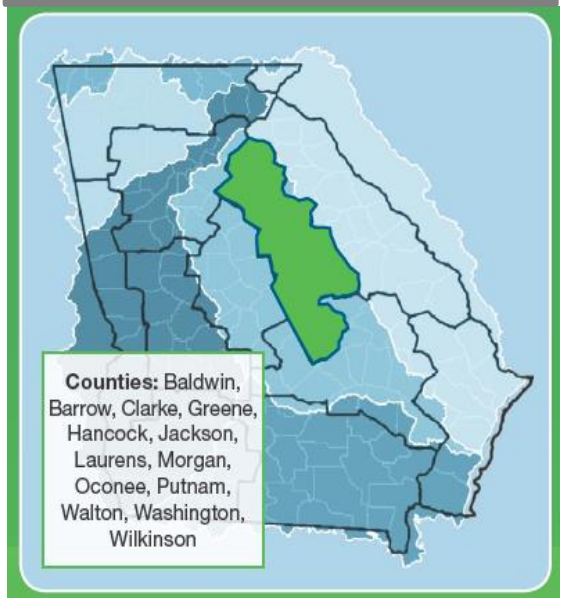
4. Water Quality—Environmental improvements through reduced pollution.

This Plan assesses the Region's current and future water and wastewater needs and describes 35 management practices that can be implemented through collaboration between local, regional, and state entities. It also presents realistic and measurable benchmarks to track short-term and long-term progress toward implementing the management practices.

Introduction

The Georgia Environmental Protection Division (GAEPD), with oversight from the Georgia Water Council, developed the first Comprehensive State-wide Water Management Plan (State Water Plan), which was adopted by the Georgia General Assembly in January 2008. The State Water Plan included a provision to create 10 water planning regions across the state, each guided by a regional water planning council. (An eleventh region and council, covering the Atlanta metro area, already existed.) Part of the mission of each council was to create a Regional Water Plan for submittal to GAEPD by the end of September 2011. The State Water Plan calls for the Regional Water Plans to be reviewed and revised every 5 years.

Figure ES-1: Location Map of Upper Oconee Water Planning Region



The Upper Oconee Regional Water Planning Council (the Council) prepared this Regional Water Plan for the Upper Oconee Water Planning Region which includes 13 counties and 62 incorporated municipalities (See

Figure ES-1). The original Regional Water Plan was completed and adopted by GAEPD in 2011, and this update was completed and adopted by GAEPD in 2017.

The Region contains portions of the Oconee, Ocmulgee, Ogeechee, Savannah, and Altamaha river basins and includes various groundwater aquifer systems, particularly the crystalline rock aquifer systems, the Cretaceous aquifer system, and the Floridan aquifer. Surface water supplies the bulk of the Region's water demands.

Process

The Upper Oconee Regional Water Planning Council represents a cross-section of public and private stakeholders within the Region's 13 counties: Baldwin, Barrow, Athens-Clarke, Greene, Hancock, Jackson, Laurens, Morgan, Oconee, Putnam, Walton, Washington, and Wilkinson. The Council adopted the following vision and goals (Table ES-1) to guide the development of this Regional Water Plan:

Vision: *Create a regional plan that focuses on managing water as a critical resource vital to our health, economic, social and environmental wellbeing. Build trusting partnerships with neighboring regions and develop an educated and engaged citizenry that embraces sound water management.*

Table ES-1: Goals for the Regional Water Plan

Number	Goal
1	Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Upper Oconee region.
2	Ensure that management practices balance economic development, recreation, and environmental interests.
3	Educate stakeholders in the region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency.
4	Encourage the development of and accessibility to data and information to guide management decisions.
5	Identify programs, projects, and educational messages to reduce non-point source pollution to protect water quality in lakes and streams.
6	Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.
7	Identify and plan measures to ensure sustainable, adequate water supply to meet current and predicted long-term population, environmental, and economic needs.

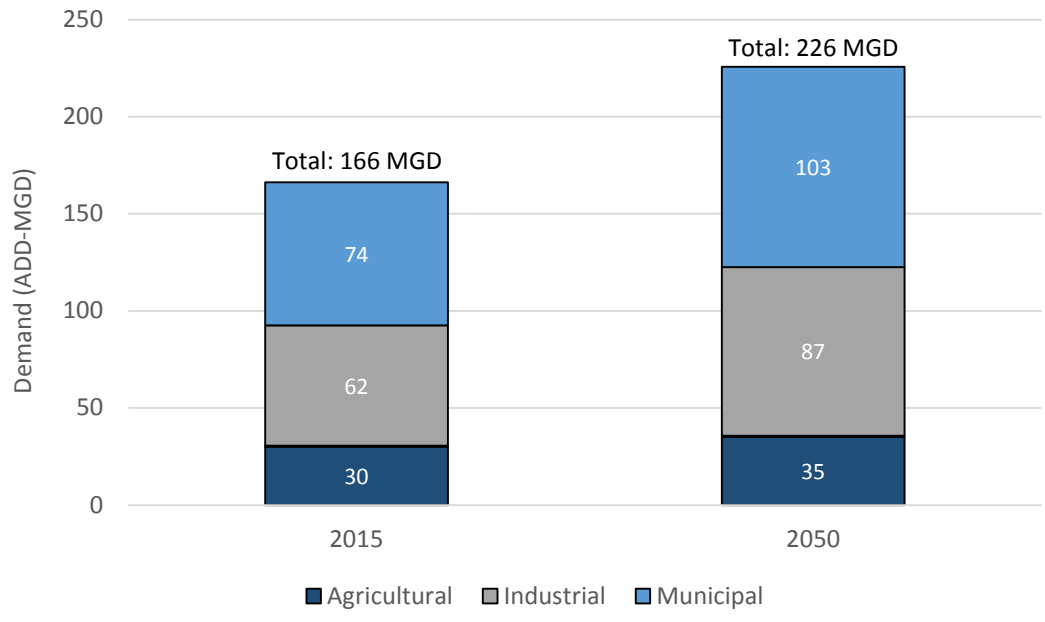
Eleven full council meetings were held between February 2009 and September 2011 to develop the original Regional Water Plan. Five full council meetings were held between March 2016 and June 2017 to conduct the review and revision of the Regional Water Plan. Council meetings included representation from state agency staff, local government and utility staff, and interested stakeholders. Additional subcommittee

meetings were held, as needed, to address specific topics such as the water and wastewater per capita demands, agricultural water demand forecasts, and the selection of management practices. Results and recommendations from subcommittee meetings were discussed and approved during full council meetings.

Water and Wastewater Demands

As shown in Figure ES-2, major water uses, based on the 2015 water demand forecast, are for municipal water supply (74 MGD or 44 percent), industrial use (62 MGD or 37 percent), and agricultural use (30 MGD or 18 percent). Both industrial and agricultural water demands are expected to increase throughout the planning horizon (i.e., through 2050); however, municipal water supply will remain the largest demand in the Region in 2050, comprising 46 percent or 103 MGD of the total (CDM, 2017). Other uses forecasted for 2050 include industrial use (38 percent) agricultural use (16 percent), and thermoelectric energy generation (0.3 percent). Municipal and industrial water demands are projected to increase steadily from approximately 136 million gallons per day (MGD) in 2015 to 190 MGD in 2050.

Figure ES-2: Water Demand Forecast per Sector

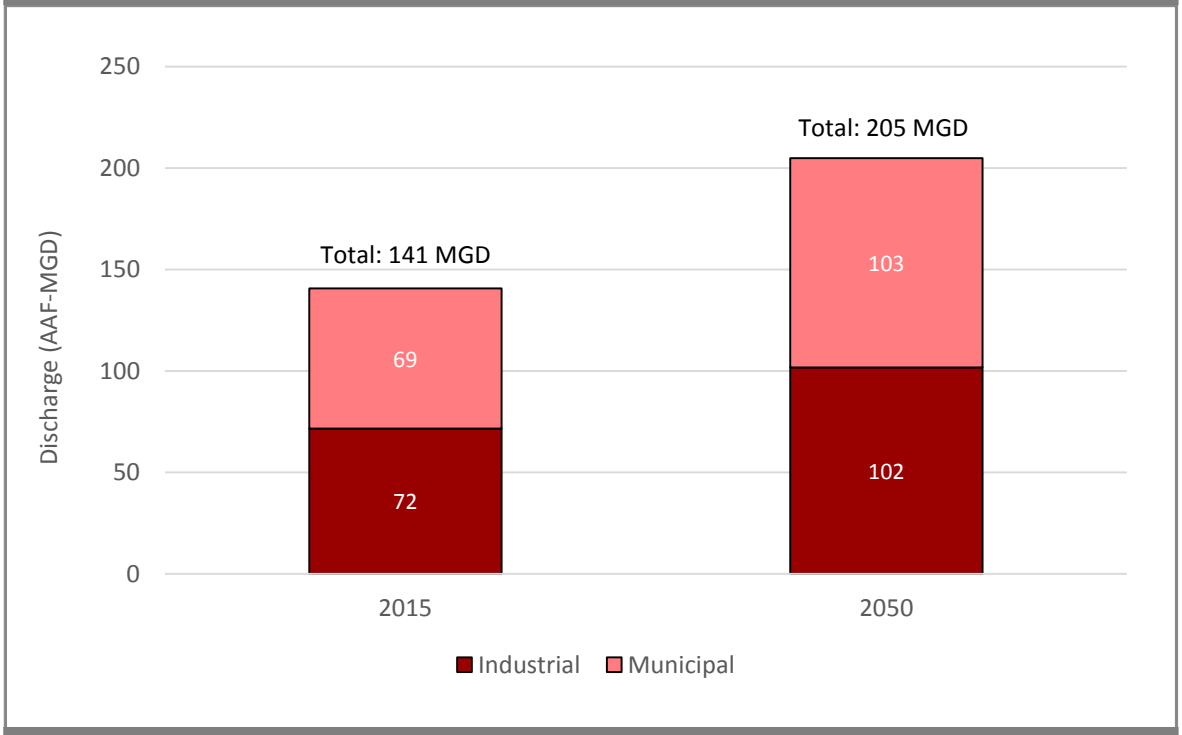


Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (CDM, 2017)

Notes: Values represent forecasted annual average demand (AAD) and include dry year (75th percentile) agricultural demands.

Figure ES-3 shows the results of the wastewater flow forecast for 2015 and 2050 by sector. Total wastewater flows in 2015 and 2050 are roughly split between municipal and industrial uses, with the total wastewater flow for both municipal and industrial uses projected to be 205 MGD in 2050.

Figure ES-3: Wastewater Flow Forecast



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (CDM, 2017)
Notes: Values represent forecasted annual average flow (AAF-MGD).

Major Findings

The GAEPD developed Resource Assessments for the State's river basins and major aquifers that examine three resource conditions:

1. **Surface Water Quality (Assimilative Capacity)** — the capacity of Georgia's surface waters to accommodate pollutants without unacceptable degradation of water quality, i.e., without exceeding State water quality standards or harming aquatic life.

2. **Surface Water Quantity**— the capacity of surface water resources to meet municipal, industrial, agricultural, and thermoelectric power water needs within thresholds indicating the potential for local or regional impacts.

3. **Groundwater Quantity**— the estimated range of sustainable yield for prioritized groundwater resources based on existing data.

The Resource Assessments identify potential shortcomings in these resources and classify them as "gaps." A gap means that the existing or future conditions exceed the Resource Assessment metric, e.g., the sustainable yield of a specific groundwater aquifer is exceeded, thus, a potential "gap" exists in groundwater availability in that area.

In addition, an analysis of existing permitted capacity (for water and wastewater facilities) versus future demands was conducted to identify potential water infrastructure "needs" and any potential wastewater infrastructure "shortages. "A need or shortage means that the current permitted capacity of water or wastewater treatment facilities, respectively, is less than the future forecast demands, e.g., a "shortage" would occur if the permitted capacity of a wastewater treatment plant in 2050 is less than the forecast demand for that year.

Table ES-2 summarizes the potential gaps and/or needs and shortages identified for each County within the Region.

Table ES-2: Summary of Potential Gaps, Needs, or Shortages by County

County	Ground-water Gaps	Surface Water Gaps	Municipal Water Needs	Municipal Wastewater Shortages	Water Quality – Assimilative Capacity Gaps	Water Quality 303(d) Issues
For more details see:	*Section 5.1*	*Figure 5-2*	*Table 5-5*	*Table 5-7*	*Figure 5-3*	*Sections 3.3.2 and 5.3.2*
Baldwin						Yes
Barrow						Yes
Athens-Clarke						Yes
Greene		Yes				Yes
Hancock		Yes				Yes
Jackson						Yes
Laurens					Yes	Yes
Morgan					Yes	Yes
Oconee						Yes
Putnam					Yes	Yes
Walton				Yes		Yes
Washington		Yes				Yes
Wilkinson					Yes	Yes
Total	0	3	0	1	4	13

Notes: "Yes" indicates that there is a potential gap or need/shortage in the indicated county or there is a water quality issue.
"Gap" is defined as a condition where the existing or future conditions exceed the Resource Assessment metric.

Based on the evaluation of the Resource Assessments and future consumption, there were only limited gaps in meeting future water demands in the Region primarily due to the storage (reservoirs) available in the basin. Water quality gaps were predicted to occur in Lakes Oconee and Sinclair due to excess nutrients in the future due to a combination of point source and nonpoint source pollutant loads from anticipated wastewater discharges and land use changes. Additional nutrient controls will be required to protect drinking water supplies, recreational activities on the lakes, and the associated economic benefits for the Region. Nutrient controls will also be required to meet the pending numeric nutrient criteria.

Recommended Management Practices

The State Water Plan defines management practices as reasonable methods, considering available technology and economic factors, for managing water demand, water supply, return of water to water sources, and prevention and control of pollution of the waters of the State. The Council ultimately selected 35 management practices within the following categories: Water Conservation (10 management practices), Water Supply (7 management practices), Wastewater (8 management practices), and Water Quality (10 management practices). In counties with no identified potential gaps based on the Resource Assessment analyses, needs, or shortages within a particular category, the management practices were selected to align with the Region's visions and goals.

Due to the diversity of water users and land uses across the basin, the Council recognized that a "one size fits all" approach to management practices was not appropriate. Therefore, the Council developed a diverse set of management practices that may be applied to address more localized, sub-regional water supply, wastewater, or water quality issues.

The Council used a prioritization process to assign a benefit ranking to each management practice. The top two management practices in each category are as follows:

- Water Conservation: (1) Encourage conservation pricing and (2) Develop water conservation goals.
- Water Supply: (1) Expand existing reservoirs and (2) Construct new water supply reservoirs.
- Wastewater: (1) Encourage implementation of centralized sewer in developing areas where density warrants and (2) Encourage development of local wastewater master plans/Evaluate wastewater treatment and disposal options to meet future demands.
- Water Quality: (1) Encourage comprehensive land use planning and (2) Encourage local government participation in construction erosion and sediment control.

The Council also developed short-term and long-term actions for implementing all management practices and identified the parties responsible for implementation. The bulk of implementation actions fall to local governments and utilities and their respective Regional Commissions (RCs); however, extensive support for initial activities, in particular, will be needed from State entities, such as the GAEPD. Cost estimates are presented that specify the estimated capital or programmatic costs and funding sources and options for each management practice. In addition, the Council compiled a list of recommendations to the State for actions that will support implementation of the Plan. It also established measurable, achievable, realistic, and time-phased benchmarks for implementing this Regional Water Plan; for example, progress in implementation of the short-term actions is recommended to be measured using an annual survey and improvements in water quality monitoring results will be measured using the GAEPD water quality database.

Overview of Plan Sections

Table ES-3 presents an overview of the Sections of this Regional Water Plan.

Table ES-3: Overview of the Regional Water Plan

Section	Title	Overview
1	Introduction	Introduction of Regional Water Planning process and the Council.
2	Upper Oconee Water Planning Region	Characteristics of the Region, including geography and watersheds, aquifers, population, and land cover.
3	Water Resources of the Upper Oconee Region	Major water uses and baseline water resource capacities.
4	Forecasting Future Water Resource Needs	Municipal, industrial, agricultural, and energy water use forecasts through 2050.
5	Comparison of Available Water Resource Capacities and Future Needs	Groundwater and surface water (quantity and quality) comparisons and identification of future gaps, needs, or shortages.
6	Addressing Water Needs and Regional Goals	Identified Management Practices to address future goals, gaps, needs, and shortages.
7	Implementing Water Management Practices	Management Practice implementation schedules, roles of responsible parties, and cost estimates. Recommendations to the State.
8	Monitoring and Reporting Progress	Benchmarks and measurement tools to track progress toward meeting goals and addressing shortfalls.
9	Bibliography	Supporting and referenced materials list.
App. A	Summary of Plan Updates	Table summarizing changes made to the original 2011 Regional Water Plan during the 2016-17 plan review and revision process.

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Section 1. Introduction

Section Summary

Georgia is developing updated Regional Water Plans for the planning regions across the state to define sustainable practices to meet regional water resource needs through 2050.

The Council defined a vision and 7 goals to guide its evaluation and selection of management practices that best meet the Region's needs. These goals include sustainable strategies to support economic development, maintain or improve water quality, and provide water for both human and aquatic resource needs.

The 2004 Comprehensive State-wide Water Management Planning Act mandated the development of a state-wide water plan that supports a far-reaching vision for water resource management: "Georgia manages water resources in a sustainable manner to support the State's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens" (Official Code of Georgia Annotated [O.C.G.A.] 12-5-522(a)). The Georgia Environmental Protection Division (GAEPD), with oversight from the Georgia Water Council, was charged with developing the first Comprehensive State-wide Water Management Plan (State Water Plan), which was adopted by the Georgia General Assembly in January 2008.

The State Water Plan included a provision to create 10 water planning regions across the State, each guided by a regional water planning council. Figure 1-1 illustrates the location of these regions relative to Georgia's river basins and counties. The preexisting eleventh planning region, the Metropolitan North Georgia Water Planning District (Metro Water District), represents 15 counties in the metropolitan Atlanta area. The Metro Water District was established in May 2001 by separate legislation and is discussed further in Section 7.3. Members of the regional water planning councils were appointed by the Governor, Lieutenant Governor, and Speaker of the House. Part of the mission of each council, including the Upper Oconee Regional Water Planning Council (the Council), was to submit the original Regional Water Plan (provided on September 30, 2011) and to participate in review and revision processes to update that plan in 5-year cycles.

Each Regional Water Plan recommends sustainable water management practices designed to meet each region's needs through the year 2050 while coordinating with the Regional Water Plans of adjoining regional water planning councils for consistency across the state. As such, this Regional Water Plan

- provides an overview of the population, land cover, and municipalities of the Upper Oconee Water Planning Region (the Region) (Section 2),
- describes the Region's existing water resources and unique characteristics (Section 3),
- forecasts the Region's future water resources needs (Section 4),

Figure 1-1: Georgia Regional Water Planning Councils

Source: GAEPD, 2009.

- compares the Region's future needs with existing capacities to identify potential water resource issues, particularly any water gaps, needs, or shortages (Section 5),
- reviews existing local and regional plans as part of an effort to select MPs to address these potential issues while still meeting the Region's goals (Section 6),
- establishes a roadmap for implementing the selected MPs (Section 7), and
- establishes benchmarks for measuring and reporting progress toward implementation (Section 8).

The original (2011) Regional Water Plan was an important first step toward achieving the vision and goals of the Region while recognizing the need for an adaptive management approach by revisiting the Regional Water Plan on a regular, 5-year cycle.

During this 2016–2017 plan update process, the original (2011) Regional Water Plan was reviewed and revised, as necessary, for the Upper Oconee Region based on updated regional water demand forecasts, updated resource assessment modeling, and evaluations of future gaps in water availability and water quality. This updated plan also includes the revised management practices recommended by the Council to either address future water resource management needs or to refine or clarify management practices.

1.1 The Significance of Water Resources in Georgia

Of all Georgia's natural resources, none is more important to the future of the State than water. The wise use and management of water is critical to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens. Georgia has abundant water resources, with 14 major river systems and multiple groundwater aquifer systems. These waters are shared natural resources. Streams and rivers run through many political jurisdictions. The rain that falls in one region of Georgia may replenish the aquifers used by communities many miles away. Nonetheless, although water in Georgia is abundant, it is not an unlimited resource and must be carefully and sustainably managed to meet long-term water needs.

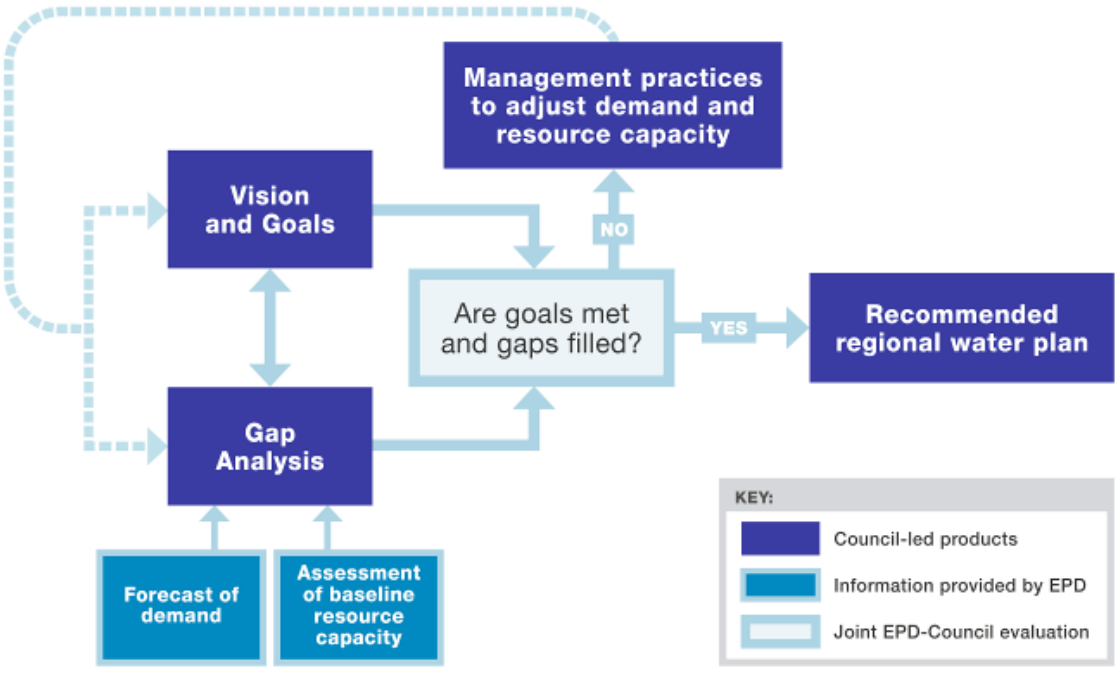
Because water resources, their conditions, and their uses vary greatly across the state, selection and implementation of management practices on a regional and local level is the most effective way to ensure that current and future needs for water supply and assimilative capacity are met. Therefore, the State Water Plan calls for the preparation of ten regional water development and conservation plans (Regional Water Plans). This Regional Water Plan prepared and updated for the Upper Oconee Water Planning Region by the Upper Oconee Regional Water Planning Council describes the regionally appropriate water management practices to be employed in Georgia's Upper Oconee Water Planning Region over the next 35 years.

1.2 State and Regional Water Planning Process

The State Water Plan called for the preparation of Regional Water Plans designed to manage water resources in a sustainable manner through 2050. It established the 10 regional water planning councils illustrated in Figure 1-1, including the Upper Oconee Council, and provided a framework for regional planning.

The original Regional Water Plans (2011) were prepared following the consensus-based planning process outlined in Figure 1-2, which integrated the input of regional water planning councils, local governments, and the public. GAEPD oversaw the planning process and, along with partner agencies, provided support to the councils. The primary role of each Council was to develop a Regional Water Plan and submit it to GAEPD for approval. The Council coordinated its efforts with councils adjacent to the Region. Specific roles and responsibilities for regional water planning councils are outlined in a Memorandum of Agreement (MOA) between each council, GAEPD and the Georgia Department of Community Affairs (DCA). As detailed in both the MOA and the Council's Public Involvement Plan[1], the process required and benefited from the input of other regional water planning councils, local governments, and the public.

Figure 1-2: State Water Planning Process



Source: GAEPD, 2009.

[1] See supplemental document on Public Involvement Plan at http://www.upperoconee.org.

The Council established a series of subcommittees which met and held conference calls throughout the original planning process to assist in development of specific elements of the Regional Water Plan. These included an executive, agriculture, media, and MP subcommittee. Results of subcommittee discussions and recommendations were presented at full Council meetings and aided in the development of specific elements of the Regional Water Plan.

For this plan update, a similar approach was followed including a review of the original vision and goals, updates to the water and wastewater demands, updates to the resource assessments, and a re-evaluation of future gaps. Public/local government input and coordination with other regional water planning councils also informed the plan update.

1.3 Upper Oconee Water Planning Region Vision and Goals

This Regional Water Plan update reflects extensive efforts on the part of the original and current participants of the Council. These efforts are described in detail in the supplemental document titled *Upper Oconee Water Council: Summary of Public Outreach and Coordination Activities* (2011), which is available on the Council website. In developing the original plan, one of the Council's first responsibilities was to establish the vision and goals for water management in the Region; these components played a critical role in the evaluation and selection of MPs that would best meet the Region's needs. The Council adopted the following vision and goals to guide the development of the original Regional Water Plan and this update:

Vision: *Create a regional plan that focuses on managing water as a critical resource vital to our health, economic, social and environmental wellbeing. Build trusting partnerships with neighboring regions and develop an educated and engaged citizenry that embraces sound water management.*

Goals:

- Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Upper Oconee region.
- Ensure that management practices balance economic development, recreation, and environmental interests.
- Educate stakeholders in the region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency.
- Encourage the development of and accessibility to data and information to guide management decisions.
- Identify programs, projects, and educational messages to reduce non-point source pollution to protect water quality in lakes and streams.

- Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.
- Identify and plan measures to ensure sustainable, adequate water supply to meet current and predicted long-term population, environmental, and economic needs.

Section 2. Upper Oconee Water Planning Region

The Region, as shown in Figure 2-1, extends from Jackson County in northeast Georgia southeast approximately 150 miles to Laurens County in the Coastal Plain of south-central Georgia. The Region is approximately 5,000 square miles in size and had an estimated population of 577,039 in 2015 (Georgia Governor's Office of Planning and Budget, 2015). The Region borders the Metro Water District to the northwest, the Altamaha Water Planning Region to the south, the Savannah-Upper Ogeechee Water Planning Region to the east, and the Middle Ocmulgee Water Planning Region to the west.

Section Summary

The Region covers approximately 5,000 square miles and includes 13 counties and 62 municipalities. Athens-Clarke County is the most populous county in the Region, while Hancock County is the least populated.

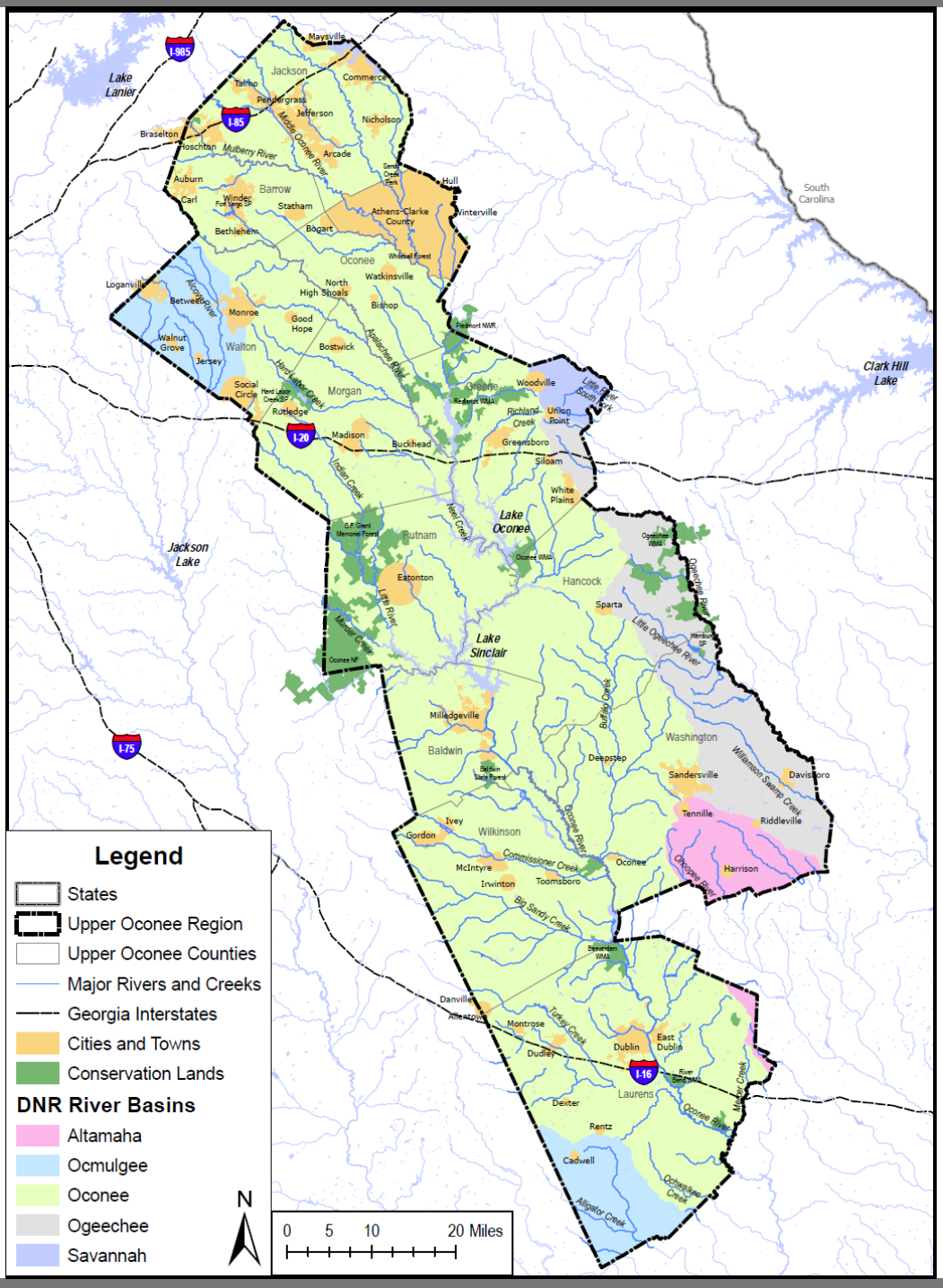
2.1 History and Geography

The Region has historical significance to the State, because it includes features such as the City of Athens—home to the University of Georgia (UGA)—and the City of Milledgeville, which was the capital of Georgia during the Civil War and one-time home of acclaimed novelist Flannery O'Connor (Jackson, 1988; Gordon, 2009). In 1785, Georgia became the first state to charter a state-supported university when UGA was incorporated by an act of the General Assembly; the university's location was selected in 1801 to be along the banks of the Oconee River in Athens-Clarke County (UGA, 2010). Due to the topography along the Ocmulgee and Oconee Rivers, the presence of their headwaters in southeast and northeast Atlanta, respectively, and Milledgeville's importance during the Civil War, General Sherman's "March to the Sea" after the Battle of Atlanta generally followed these waterways as his troops made their way southward to Savannah (Clark, 1999; UGA, 2008a).

2.1.1 Local Governments

Local governments in the Region include 13 counties and 62 incorporated municipalities with jurisdictional authority, as illustrated in Figure 2-1 and listed in Table 2-1. These local governments are responsible for land use and zoning decisions that affect local water resources management. Many local governments are also responsible for the planning, operation, and management of water and wastewater infrastructure.

Figure 2-1: Counties and Cities in the Upper Oconee Region



Source: CH2M HILL, 2009.

Table 2-1: Upper Oconee Counties, Cities, and Towns	
County	**Cities and Towns**
Baldwin	Milledgeville[a]
Barrow	Auburn, Bethlehem, Braselton, Carl, Statham, Winder[a]
Athens-Clarke	Athens[a], Bogart, Winterville
Greene	Greensboro[a], Siloam, Union Point, White Plains, Woodville
Hancock	Sparta[a]
Jackson	Arcade, Braselton, Commerce, Hoschton, Jefferson[a], Maysville, Nicholson, Pendergrass, Talmo
Laurens	Allentown, Cadwell, Dexter, Dudley, Dublin[a], East Dublin, Montrose
Morgan	Bostwick, Buckhead, Madison[a], Rutledge
Oconee	Bogart, Bishop, North High Shoals, Watkinsville[a]
Putnam	Eatonton[a]
Walton	Between, Good Hope, Loganville, Jersey, Monroe[a], Social Circle, Walnut Grove
Washington	Davisboro, Deepstep, Harrison, Oconee, Riddleville, Sandersville[a], Tennille
Wilkinson	Allentown, Danville, Gordon, Irwinton[a], Ivey, McIntyre, Toomsboro
[a] County Seat	

2.1.2 Watersheds and Water Bodies

While primarily centered on the Upper Oconee River basin, the Region also includes portions of four other river basins as shown in Figure 2-1. Section 3 describes the Region's water use classifications and impaired waters. The headwaters of the Oconee River originate in Hall County, just upstream of the Region, where the Middle Oconee and North Oconee Rivers originate. These two rivers flow independently for 55-65 miles before merging below Athens to form the Oconee River. The latter flows south for another 220 miles to its confluence with the Ocmulgee River to form the Altamaha River, just downstream of the Region.

From the junction of the North and Middle Oconee Rivers, the Oconee River flows for about 20 miles to the northern end of Lake Oconee, a 19,050-acre reservoir formed by Wallace Dam. Immediately downstream of Lake Oconee is 15,330-acre Lake Sinclair behind Sinclair Dam (located approximately 5 miles upstream of Milledgeville). Both impoundments are used for hydropower generation. Georgia Power Company (Georgia Power) pumps water from Lake Sinclair upstream to Lake Oconee as needed to generate additional hydropower at Wallace Dam, a pumped-storage project.

2.1.3 Physiography and Groundwater Aquifers

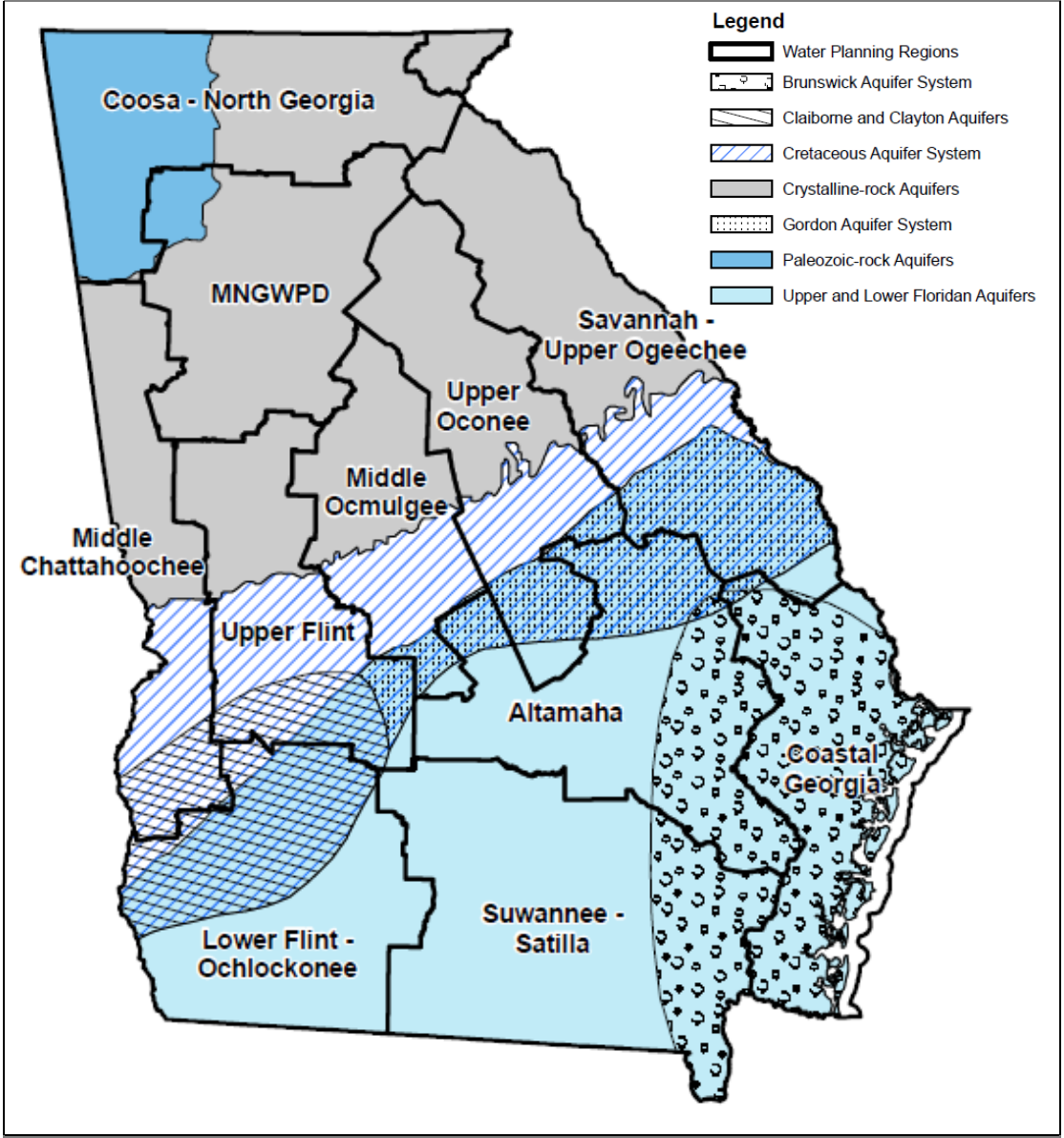
The Region is characterized by a moist and temperate climate with mean annual precipitation ranging from 47 inches in the lower basin to 56 inches in the basin headwaters. The driest months are September and October, and the wettest month is March (GAEPD, 1998).

The Region encompasses parts of two physiographic provinces: the Piedmont and Coastal Plain. The Piedmont province is characterized by low hills and narrow valleys, while the Coastal Plain is characterized by flatter terrain and sandy soils. The Fall Line forms the boundary between the two provinces. Streams flowing across the Fall Line, as the name implies, can undergo abrupt changes in gradient that are marked by the presence of rapids and shoals. Geomorphic characteristics of streams also differ between the Piedmont and Coastal Plain provinces. In the Coastal Plain, streams typically lack the riffles and shoals common to streams in the Piedmont and exhibit greater floodplain development and increased sinuosity.

The Region includes portions of three aquifer systems that were prioritized for determination of sustainable yield by GAEPD. These aquifers are the Crystalline rock aquifer systems, the Cretaceous aquifer system, and the Floridan aquifer (Figure 2-2). The Piedmont portion of the Region includes the Crystalline rock aquifer. These aquifer systems occur in metamorphic and igneous rocks where secondary porosity and permeability has developed as a function of differential weathering along discontinuities. Enlargement of discontinuities provides discreet pathways for groundwater storage and flow. The intersection and interconnection of these features creates localized aquifer systems within the bedrock that are dependent on many variables of each rock unit. Although these aquifer systems do not typically provide significant quantities of groundwater over the Region, local topographic and geologic conditions are conducive to development of discreet aquifer systems with sufficient sustainable yield to supplement water supply. These aquifer systems are typically local in extent, and the yield and groundwater chemistry can be affected by localized water use and climate. However, if properly managed these aquifer systems can provide drought-resistant sources of groundwater to supplement surface water supplies.

The Coastal Plain portion of the Region includes the Cretaceous aquifer system and Floridan aquifers. As shown in Figure 2-2, the Cretaceous aquifer systems crop out in a narrow band just south of the Fall Line. These aquifer systems, primarily comprised of the Providence and Eutaw-Dublin aquifers, are geologically older than the Floridan aquifer and serve as a major source of water in the northern third of the Coastal Plain. These aquifer systems primarily consist of a wedge-shaped package of sand and gravel that thickens and dips to the southeast with local layers of clay and silt that function as confining to semi-confining.

Figure 2-2: Groundwater Aquifers



Source: GAEPD, 2009.

The Region lies in the portion of the Floridan aquifer system comprised of primarily unconsolidated coarse-grained clastic sands and gravels. Only a small portion of the Floridan aquifer is located within the Region and is primarily used for domestic purposes and is less productive than other parts of the aquifer. The Floridan aquifer system is one of the most productive groundwater storage areas in the United States. The Floridan supplies about 50 percent of the groundwater used in Georgia and serves as a major water source

throughout the Coastal Plain of Georgia. Wells in this aquifer are generally high-yielding and are extensively used for irrigation, municipal supplies, industry, and private domestic supply.

2.2 Characteristics of the Region

The Region's population, employment, and land use are briefly discussed in the following sub-sections. Also included is an examination of regional and local planning organizations.

2.2.1 Population

The total population for the 13-county Region was estimated at 577,039 in 2015 (Georgia Governor's Office of Planning and Budget, 2015). Athens-Clarke County is the most populated county in the Region, with approximately 123,489 residents. Walton, Barrow, and Jackson Counties also have populations greater than 50,000; however, the remaining 9 counties in the Region have populations below 50,000. The 4 most populous counties represent approximately 60 percent of the total population in the Region.

2.2.2 Employment

Based on Department of Labor and U.S. Census Bureau estimates, the Region's employment is dominated by the government, health care, services, manufacturing, retail, and construction sectors. The estimated total employment in the Region was 253,582 in 2015 (U. S. Bureau of Labor Statistics, 2016). The unemployment rate for the Region was 5.8 percent at that time compared to 5.9 percent unemployment rate statewide.

The Region includes five of Georgia's higher learning institutions which contribute significantly to the economy of the communities in which they are located. They are UGA, Georgia College and State University, Athens Technical College, Heart of Georgia Technical College, and Sandersville Technical College.

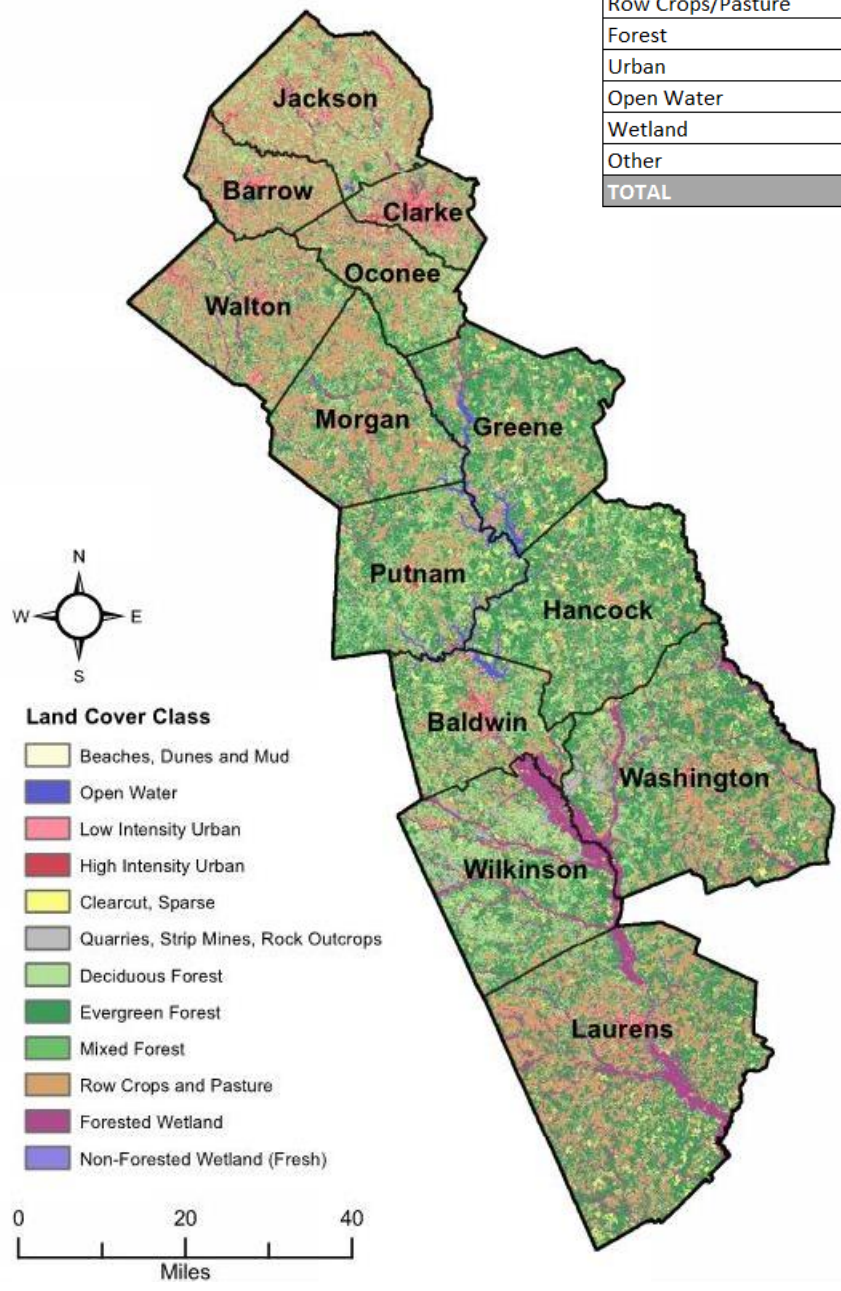
2.2.3 Land Use

Figure 2-3 illustrates the diverse land cover distribution within the Region in 2008. Athens-Clarke County is the most urbanized county in the Region; land cover in the balance of the northern counties have a suburban or rural residential mix composed of low-intensity urban, forested lands, and row crop/pasture lands. With the exception of limited pockets of urban land around Eatonton and Milledgeville, most of the lands in the central portion of the Region contain forest, row crop/pasture, or clearcut/sparse vegetation.

The land cover distribution in the lower third of the Region is even less developed; Washington and Laurens Counties have a large percentage of land used for row crops or as pasture lands. Unique to Wilkinson and Washington Counties are large pockets of quarries, mining, or rock outcrops found in the headwaters of Big Sandy Creek, along Commissioner's Creek, Buffalo Creek, and the Oconee River. Wide riverine corridors of forested wetlands are relatively common in the lower third of the Region and parallel the Oconee River, Black Creek, Little Ohoopee Creek, and the Ogeechee River.

Figure 2-3: 2008 Land Cover in the Upper Oconee Region

Land Coverage Category	Acres	% of Total
Row Crops/Pasture	618,427	19%
Forest	1,760,339	55%
Urban	254,764	8%
Open Water	53,153	2%
Wetland	289,603	9%
Other	202,002	6%
TOTAL	3,178,287	100%



Source: UGA, 2008b.

2.3 Local Policy Context

The Region includes portions of four Regional Commissions (RCs): Northeast Georgia, Central Savannah River Area, Middle Georgia, and Heart of Georgia-Altamaha (See Table 2-2). Georgia's 12 RCs are quasi-governmental regional planning organizations created and managed under Georgia law by their member local governments to serve regions that share similar economic, physical, and social characteristics. The RCs, working with the Department of Community Affairs (DCA), assist communities with a variety of planning issues, including local government planning, economic development, sustainable growth planning, and grant preparation and administration. Each RC reviews local comprehensive land use plans and can help coordinate connections between growth and water planning.

Table 2-2: Regional Commissions by County

Commissions	Counties
Northeast Georgia	Athens-Clarke, Barrow, Greene, Jackson, Morgan, Oconee, Walton
Central Savannah River Area	Hancock, Washington
Middle Georgia	Baldwin, Putnam, Wilkinson
Heart of Georgia - Altamaha	Laurens

Local governments develop ordinances, policies, and plans to meet the requirements of State and Federal water resource regulations. For example, communities with existing stormwater permits within the Region have developed local requirements for erosion and sediment control, post-construction runoff control, and other regulatory programs. Local governments can be contacted directly for access to their individual ordinances, policies, and plans.

Section 3. Water Resources of the Upper Oconee Region

This Section summarizes existing conditions in the Region, including existing water usage by sector (i.e., municipal industrial, agriculture, and energy production), surface water and groundwater availability, and water quality conditions.

Section Summary

The Resource Assessments indicate that most streams in the Region have sufficient assimilative capacity; however, select segments of the Oconee River and its smaller tributaries have exceeded their available assimilative capacity. No gaps in water availability were identified under current water use conditions.

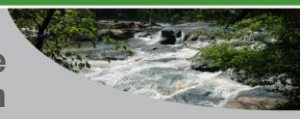
GAEPD has evaluated 1,171 stream miles in the Region; of these, 70 percent are not currently supporting their designated use, primarily due to impaired biological communities (fish or macroinvertebrates) or due to high fecal coliform levels.

3.1 Major Water Use in Region

Major water use and water returns are summarized for the Upper Oconee Region based on data compiled by USGS in the report, *Water Use in Georgia by County for 2010 and Water-Use Trends, 1985-2010*, (USGS, 2016). For planning purposes, "water withdrawal" is defined as removal of water from a water source for a specific use. Depending on the type of use, a portion of the withdrawn water is not returned to a water source as a measurable discharge. "Water consumption" (or consumptive use) is the difference between the amount of water withdrawn from a water source and the amount returned. USGS reports water use for four major water use sectors:

- **Municipal**—water withdrawn by public and private water suppliers and delivered for a variety of uses (such as residential, commercial, and light industrial).
- **Industrial**—water used for fabrication, processing, washing, and cooling at facilities that manufacture products, including steel, chemical and allied products, paper, and mining. These industrial categories use the largest amount of water of all the industrial classifications in Georgia.
- **Energy**—water used to generate electricity, mainly for cooling purposes at thermoelectric plants. Water returns vary depending on the cooling technology used by each plant.
- **Agriculture**—water for crop irrigation, which covers more than 95 percent of Georgia's irrigated land. Nursery water use, animal operations and golf courses with agricultural water use permits are not included in the forecasts, but estimates of current use are available and provided in the supplemental document titled *Agricultural Water Demand Forecast for the Upper Oconee Region*, which is available on the Council website.

As shown in Figure 3-1, surface water is the predominant source of water in the Region. In 2010, surface water and groundwater withdrawals to supply the four major water use sectors totaled approximately 1,095 million gallons per day (MGD) on an annual average demand



(AAD) basis. The annual average demand (AAD) value is the total amount of water withdrawn in a year from surface and ground water sources divided by 365 days.

Figure 3-2 shows the surface water withdrawal in 2010 by major water withdrawal sector. Thermoelectric energy production was the largest water withdrawal category (92 percent), followed by municipal withdrawal (4 percent). The majority of the water withdrawn in this Region in 2010 was for energy production at four in-stream hydropower plants and one thermoelectric facility; however, water consumption at the hydropower plants is negligible, because most of it is returned to its source. Likewise, the thermoelectric facility—Georgia Power's Plant Harlee Branch (Plant Branch) on Lake Sinclair in Putnam County—uses mainly a once-through cooling system with negligible water consumption. In 2010, Plant Branch withdrew approximately 952 MGD of surface water. Plant Branch is being decommissioned and water use from this facility is not included in the future conditions assessment (Section 5).

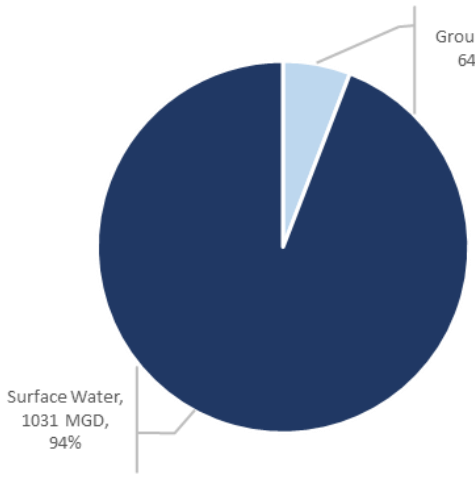
Figure 3-3 shows groundwater withdrawals in 2010 by major sector. The leading groundwater use in the Region is industrial (45 percent), then agricultural (28 percent), followed by municipal (13 percent). The main groundwater supply sources for the Region are the Cretaceous and Crystalline rock aquifers. However, the Crystalline rock aquifer system provides very limited amounts of water because of its geologic limitations.

Wastewater treatment for the Region is summarized in Figure 3-4. 418 MGD of surface water was returned on an annual average daily basis. 88 percent of surface water returned was from the energy sector, 7 percent from municipal sources, and 5 percent from industry.

Figure 3-4 shows that the leading method for treating wastewater is by facilities with point source discharges including energy production. In contrast to Figure 3-4, if energy production returns are excluded, a significant portion of the municipal wastewater generated in the Region is treated by private onsite treatment systems, such as septic tanks, in areas where public collection systems are unavailable.

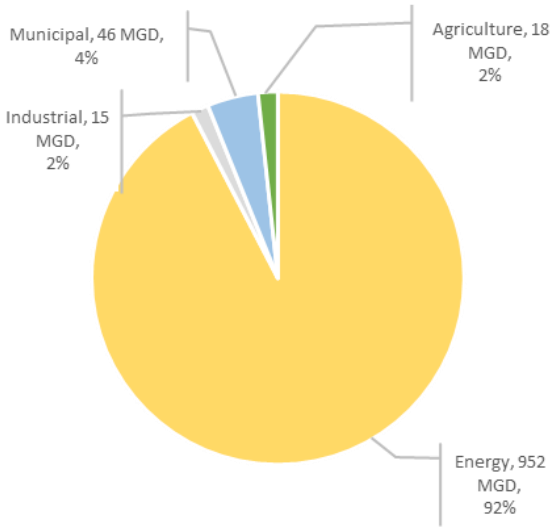
Throughout the planning process and in the Resource Assessments, existing agricultural water use, onsite sewage treatment, and LASs were considered to be consumptive. Although water may ultimately return to its source from these applications, it is not considered to be returned within a time frame that allows for it to offset the impact of related withdrawals.

Figure 3-1: 2010 Water Supply by Source Type



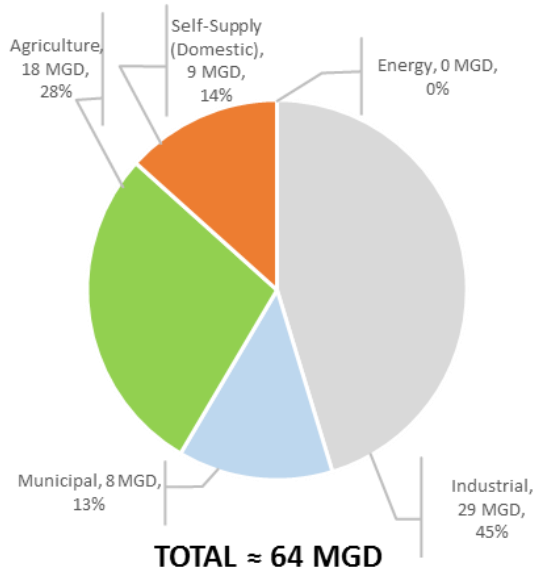
TOTAL ≈ 1095 MGD

Figure 3-2: 2010 Surface Water Withdrawal by Category



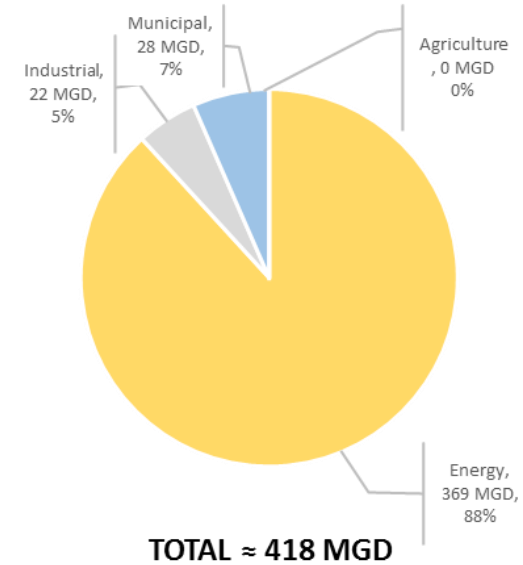
TOTAL ≈ 1031 MGD

Figure 3-3: 2010 Groundwater Use Withdrawal Category



TOTAL ≈ 64 MGD

Figure 3-4: 2010 Surface Water Return Flow by Category

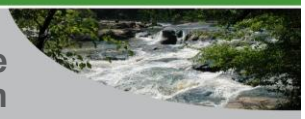


TOTAL ≈ 418 MGD

Data Source: "Water Use in Georgia by County for 2010; and Water-Use Trends, 1985-2010 (USGS, 2016)

3.2 Current Conditions Resource Assessments

GAEPD developed three Resource Assessments: (1) surface water quality (assimilative capacity), (2) surface water availability, and (3) groundwater availability. The Resource



Assessments determined the capacity of water resources to meet demands for water supply and to accommodate corresponding wastewater discharge needs without unreasonable impacts. The Resource Assessments were completed on a resource basis (river basins and aquifers), but are summarized here as they relate to the Region. The following Section describes the Resource Assessments results used to define "baseline conditions" and the state of the basin under current uses and demands. Full details of each Resource Assessment can be found on the State Water Planning website.

In the context of the Resource Assessments, a potential "gap" is defined as a condition where the modeled existing or future conditions exceed the Resource Assessment metric. For example, if the estimated sustainable yield of a specific groundwater aquifer is exceeded, then there would be a "gap" in groundwater availablity in that area. Similarly, if an existing water quality standard for nutrient loadings to a lake is exceeded, then there would be a potential water quality "gap" for that location. By contrast a potential "need" or "shortage" (discussed in Section 5) is defined as a condition where the current permitted capacity of water or wastewater treatment facilities, respectively, is less than the future forecast demands. For example, a potential "shortage" would occur if the permitted capacity of a wastewater treatment plant is 10 MGD and the forecast demand is 20 MGD.

3.2.1 Surface Water Quality (Assimilative Capacity)

The Surface Water Quality (Assimilative Capacity) Assessment estimates the capacity of Georgia's surface waters to accommodate pollutants without harming aquatic life or humans who come in contact with the water. A water body can be overloaded and violations of water quality standards may result. Water quality standards define the uses of a water body and set pollutant limits to protect those uses. The Assimilative Capacity Resource Assessment evaluated the capacity of surface waters to process pollutants without violating water quality standards. The assimilative capacity results for the existing conditions focus on dissolved oxygen (DO), nutrients (specifically nitrogen and phosphorus), and chlorophyll *a* (the green pigment found in algae, which serves as an indicator of lake water quality). Fish and other aquatic organisms need oxygen to survive; therefore, DO standards have been established to protect aquatic life. Nutrients are required for plant production, which provides food for aquatic organisms; however, if nutrient concentrations are too high, algal blooms can occur, negatively affecting recreational use of the water and potentially impacting taste and odor in water supplies.

The Assimilative Capacity Resource Assessment evaluated the impact of current wastewater and stormwater discharges, combined with current withdrawals, land use, and meteorological conditions, on DO, nutrients, and chlorophyll *a* and the assimilative capacity of stream segments that receive wastewater discharges. For current conditions, municipal and industrial wastewater discharges are evaluated as operating at their full permitted discharge levels (flow and effluent discharge limits as of 2014). The waters in the Region have a daily average DO standard of ≥5 milligrams per liter (mg/L). GAEPD recognizes that waters in the Coastal Plain may have naturally occurring low DO (less than 5mg/L); limited flexibility is allowed in these cases within a range of 10 percent; if DO is naturally below 3 mg/L, the regulations allow for an additional 0.1-mg/L DO deficit.

The majority of the modeled stream segments in the Upper Oconee basin appear to have "good" to "very good" available assimilative capacity for DO under critical conditions. Table 3-1 and Figure 3-5 show the results of the modeling. Assimilative capacity can range from "very good" to "exceeded." Initial baseline modeling results indicate that the segment of the Oconee River downstream of the confluence of Turkey Creek in Laurens County had exceeded their available assimilative capacity. Smaller tributaries such as Shoal, White Oak, Glady and Grady Creeks are also exceeding their assimilative capacity. These modeled exceedances may be due to discharges from secondary treatment plants into low-flow streams. Additional data may need to be collected for these streams to confirm these potential impairments. The results also indicate that expansions of facilities near streams with limited or no assimilative capacity may require future upgrades to wastewater treatment plants (WWTPs) discharging to these tributaries.

Table 3-1: Assimilative Capacity for DO in Upper Oconee Region

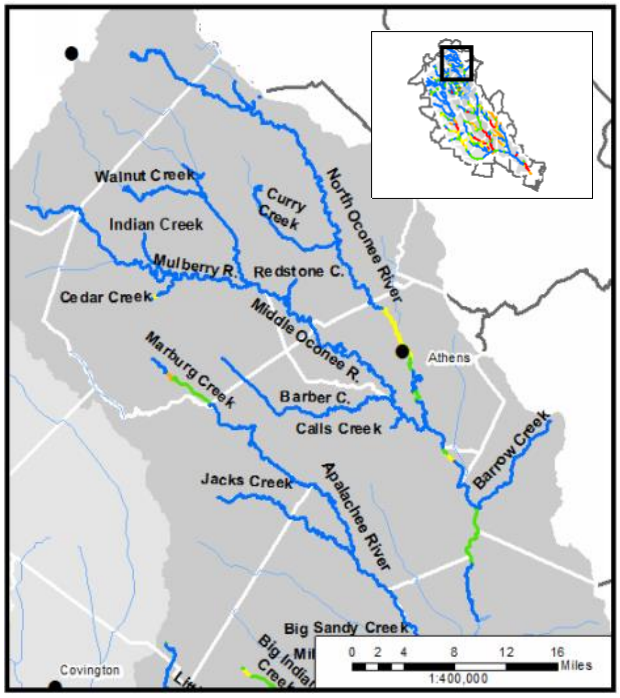
Basin	Available Assimilative Capacity (Total Mileage)						Total River Miles in the Region
	Very Good (≥1.0 mg/L)	Good (0.5 to <1.0 mg/L)	Moderate (0.2 to <0.5 mg/L)	Limited (>0.0 to <0.2 mg/L)	None or Exceeded (<0.0 mg/L)	Unmodeled	
Altamaha	7	8	4	6	0	0	25
Ocmulgee	38	4	1	2	9	0	54
Oconee	371	148	46	21	35	0	621
Ogeechee	29	30	52	5	0	0	116
Savannah	1	0	0	0	0	0	1

Source: GAEPD, 2017c

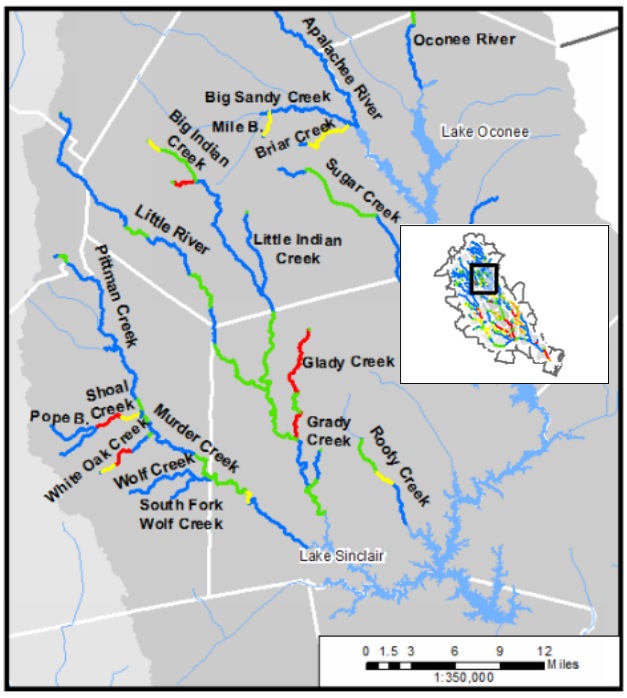
There are currently no established chlorophyll *a* or nutrient (total phosphorus and/or total nitrogen) standards for Lake Oconee or Lake Sinclair. Therefore, results for chlorophyll *a*, total nitrogen, and total phosphorus loading for these lakes were compared to the standards for Lake Jackson. Lake Jackson, located in the adjacent Middle Ocmulgee Water Planning Region, has a growing season average chlorophyll *a* standard of 20 micrograms per liter (µg/L). Modeling was completed for Lakes Sinclair and Oconee for 2001 through 2012, a period which included both wet and dry years. The modeled chlorophyll *a* response in Lake Sinclair would meet the Lake Jackson standard. The modeled chlorophyll *a* response in Lake Oconee would have exceeded the Lake Jackson standard during the drought periods of 2003-05 and 2010-11 in the midlake area of Lake Oconee (at the Hwy 44 bridge). This could be due to point source nutrient loadings from the Athens and eastern metro Atlanta areas as well as loadings from agricultural sources (GAEPD, 2017c).

Figure 3-5: Results of Assimilative Capacity Assessment – DO under Current Permit Conditions
Source: GAEPD, 2017.

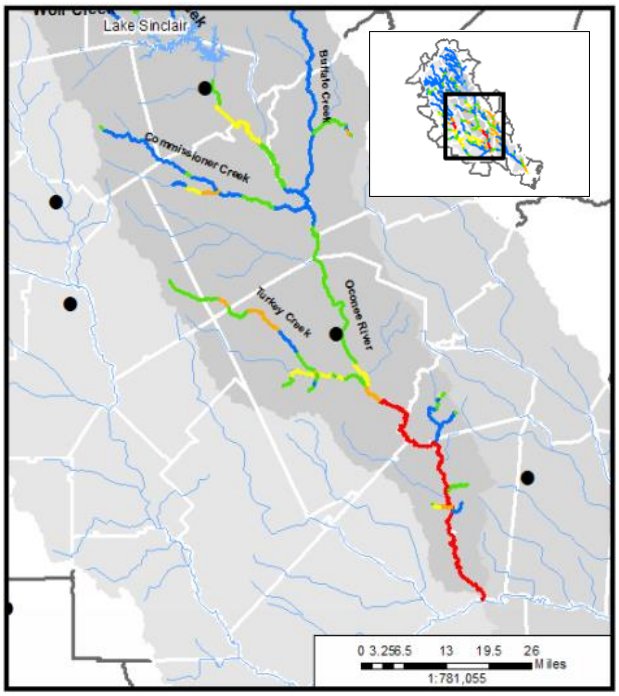
SAVANNAH BASIN



OCONEE BASIN



OCONEE BASIN



Legend

Avalable Assimilative Capacity

- Very Good ≥ 1 mg/L DO available
- Good 0.5 mg/L to < 1 mg/L DO available
- Moderate 0.2 mg/L to < 0.5 mg/L DO available
- Limited >0 mg/L to <0.2 mg/L DO available
- At Assimilative Capacity 0 mg/L DO available
- None or Exceeded < 0.0 mg/L DO available
- Unmodeled Lakes and Streams

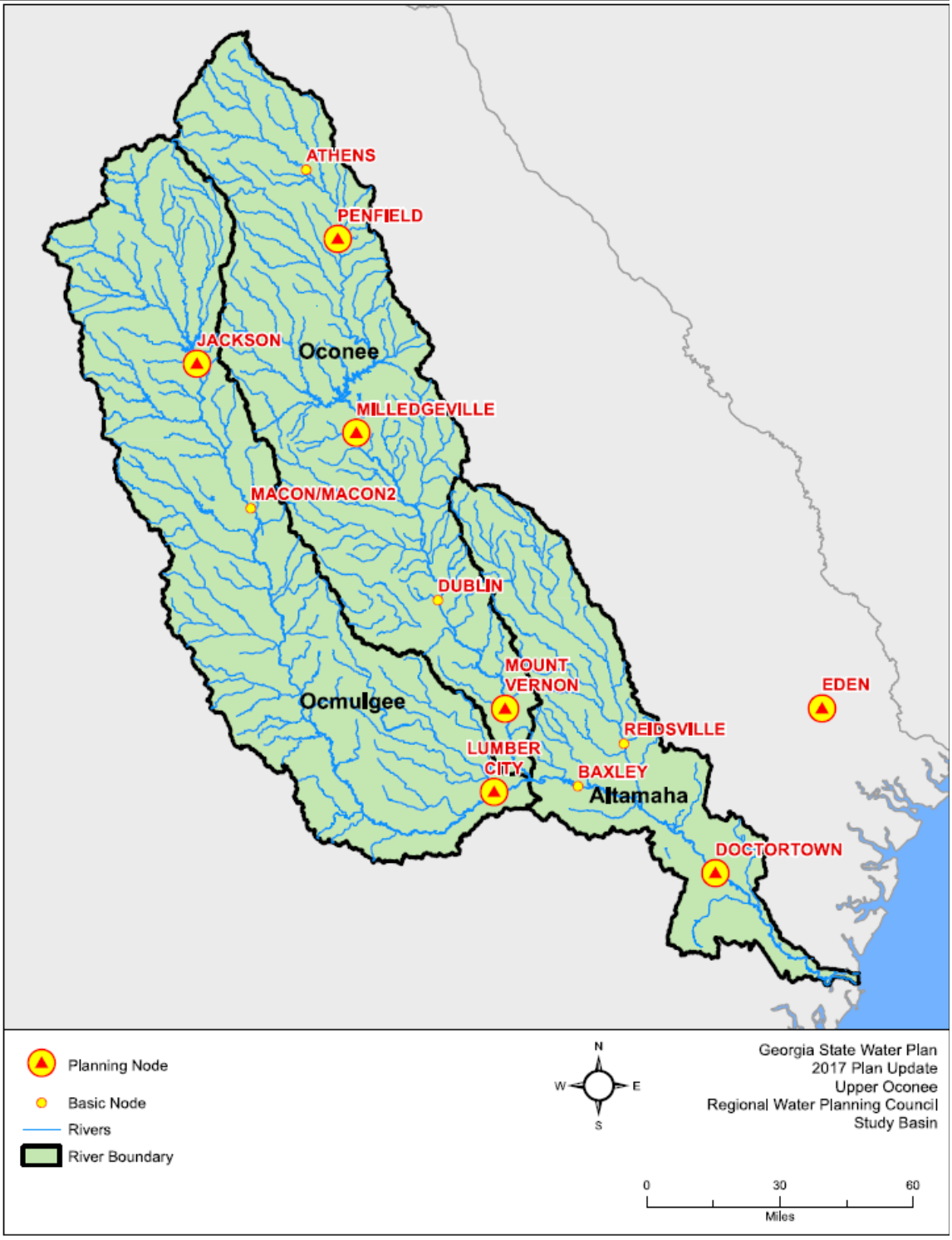
3.2.2 Surface Water Availability

The Surface Water Availability Resource Assessment estimates the ability of surface water resources to meet current municipal, industrial, agricultural, and thermoelectric power water needs, as well as the needs of in-stream and downstream users. The assessment evaluated the impact of water consumption (withdrawals from a water body that are not returned to that water body) on stream flows at certain locations in each river basin. Modeled stream flows were compared with a flow regime based on low flow thresholds selected as indicators of the potential for water consumption to impact instream uses such as fishing, boating, and aquatic life habitat. For streams where federal requirements for reservoir releases are in place, low flow thresholds have been established through site-specific analysis. In other streams, a low flow threshold from state policy was used. The modeled flow was compared with the flow regime; where the modeled stream flow was less than the flow regime, a potential "gap" was identified. The potential gaps were analyzed in terms of both magnitude (how much the modeled stream flow would drop below the flow regime) and duration (number of days the stream flow fell below the flow regime).

Figure 3-6 illustrates the local drainage areas and planning nodes used in developing the Surface Water Resource Assessment. Planning nodes were locations within the watershed where existing flow data were available to assess current and future water availability.

The Region is part of the Oconee-Ocmulgee-Altamaha River basin which includes three planning nodes, or points where in-stream flow was analyzed, along the Oconee River (Penfield, Milledgeville and Mount Vernon). No potential gaps were predicted under current withdrawal and discharge conditions at these nodes. Three other planning nodes are located outside the Region but include upstream watershed areas that are a part of the Region (Jackson, Lumber City and Eden).

Figure 3-6: Local Drainage Areas and Planning Nodes in the Region



Source: GAEPD, 2009.

3.2.3 Groundwater Availability

The Groundwater Availability Resource Assessment evaluates the amount of water that can be withdrawn from modeled areas of a prioritized aquifer without reaching specific thresholds of local or regional impacts. Indicators of impacts included declines in groundwater levels that may affect neighboring wells (drawdown) and reductions in the amount of groundwater that seeps into streams and thereby contributes to streamflows. The assessment estimates a range of yield that can be withdrawn from an aquifer before specific thresholds are met. The results reflect modeled aquifer responses to specific baseline conditions and specific pumping scenarios. GAEPD prioritized the aquifers based on their characteristics, and evidence of existing impacts, as well as potential future impacts. The Region includes three prioritized aquifer systems: the Crystalline rock aquifer, the Cretaceous aquifer system, and the Floridan aquifer. The Crystalline rock aquifer system lies within the upper portion of the Oconee River watershed; the Cretaceous and Floridan aquifer systems lie within the Ocmulgee, Oconee, and Altamaha River watersheds in the Region. GAEPD developed a regional numerical groundwater model to estimate sustainable yield in the Floridan aquifer of south-central Georgia and the eastern Coastal Plain of Georgia and the Cretaceous aquifer system; a water budget approach developed for the basin within the Crystalline rock aquifer system was used to estimate sustainable yield in this part of the Region.

Based on the analyses, the combined Coastal Plain aquifer systems, including areas outside the Region, currently support approximately 667 MGD of pumping with a sustainable yield ranging from 1,066 MGD to 1,229 MGD in total. Conservative estimates (low yield and high agricultural use) project an additional approximate 45 MGD yield available in 2050 within the Coastal Plain and the Cretaceous aquifers between Macon and Augusta. These aquifers serve Washington, Wilkinson, and Laurens Counties, as well as areas outside the Region, which have a sustainable yield ranging from 347 MGD to 445 MGD. Within the Cretaceous aquifer system, approximately 100 MGD is pumped from the Providence aquifer and 24 MGD is pumped from the Eutaw-Midville aquifer (GAEPD, 2011). It should be noted that the groundwater yield estimates are based on the capacity of the entire aquifer system and local or regional groundwater yields may vary.

Although most wells produce less than 200 gallons per minute (gpm) in the Crystalline rock aquifers, in local geologically unique settings, several wells exist with production rates between 200 and 500 gpm (Georgia Geologic Survey, 2006). Although there are potential sustainable yield limitations in the Crystalline rock aquifer systems that locally serve portions of Athens-Clarke, Jackson, Barrow, and Oconee Counties, data analysis indicates that there is a limited amount of additional groundwater available above its current use, assuming that conditions are similar to those in the Piedmont Study basin (GAEPD, 2010a).

Typical water quality issues known to be associated with the Crystalline rock aquifer systems include elevated iron/manganese levels and local concentration of radionuclides. Groundwater within the Floridan aquifer is generally hard (calcium bicarbonate-rich) with few surface or groundwater quality problems in the area. Dominant cations include calcium, magnesium, sodium, and potassium; dominant anions include bicarbonate, chlorine and sulfate. Water from the Cretaceous aquifer system is reported to be generally of good chemical quality, although lower values of pH have been reported locally (Clarke et al., 1985; Johnson and Bush, 1988).

3.3 Ecosystem Conditions and In-Stream Use

This section includes information on stream classifications, impaired waters, priority watersheds, conservation areas, and fisheries resources.

3.3.1 Water Use Classifications (Designated Uses)

In accordance with the Clean Water Act, GAEPD classifies each of its surface waters according to six designated uses: (1) drinking water supply; (2) recreation; (3) fishing—propagation of fish, shellfish, game and other aquatic life; (4) wild river; (5) scenic river; and (6) coastal fishing. Each designated use has numeric and narrative water quality criteria developed to protect the use. At a minimum, all waters are classified as fishable. Table 3-2 lists the water bodies in the Region that are classified by the State for uses other than fishing. There are six separate stream segments classified as drinking water sources. These waters will also support the fishing use and any other use requiring water of a lesser quality. Additionally, the Oconee River from Georgia Highway 16 to the Sinclair Dam (i.e., including Lake Sinclair) is designated for recreational activities, such as water skiing, boating, and swimming, or for any other use requiring water of a lesser quality, such as recreational fishing.

Table 3-2: Special Stream or Reservoir Classification

Stream/Reservoir	Reach	Counties	Classification[a]
Alcovy River	Maple Creek to Cornish Creek (including John T. Briscoe Reservoir)	Walton	Drinking Water
Apalachee River	Shoal Creek to Freeman Creek	Walton, Oconee, Morgan	Drinking Water
Beaverdam Creek	Headwaters to confluence with Alcovy River	Walton	Drinking Water
Barber Creek	Headwaters to Parker Branch	Barrow, Oconee	Drinking Water
Bear Creek	Headwaters to confluence with Middle Oconee River (including Bear Creek Reservoir)	Barrow, Jackson, Athens-Clarke	Drinking Water
Big Haynes Creek	Georgia Highway 78 to confluence with Yellow River	Walton	Drinking Water
Curry Creek	Headwaters to confluence with Little Curry Creek	Jackson	Drinking Water
Fort Creek	Headwaters to confluence with Sikes Creek upstream of Lake Sinclair	Hancock	Drinking Water
Hard Labor Creek	Headwaters to Lake Brantley Dam	Morgan, Walton	Drinking Water

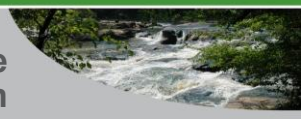
Table 3-2: Special Stream or Reservoir Classification

Stream/Reservoir	Reach	Counties	Classification[a]
Hard Labor Creek	Lake Rutledge Dam to Mile Branch	Morgan	Drinking Water
Jacks Creek	Headwaters to Grubby Creek	Walton	Drinking Water
Lake Oconee	Lake Oconee to Lake Oconee Dam (Wallace Dam)	Greene, Hancock, Morgan, Putnam	Recreation and Drinking Water
Lake Sinclair	Lake Oconee Dam downstream to Sinclair Dam	Baldwin, Hancock, Putnam	Recreation and Drinking Water
Middle Oconee River	Beech Creek to McNutt Creek	Athens-Clarke, Jackson	Drinking Water
North Oconee River	Cedar Creek to Gravelly Creek	Hall, Jackson	Drinking Water
North Oconee River	Shankles Creek to Trail Creek	Athens-Clarke	Drinking Water
Oconee River	Sinclair Dam to Fishing Creek	Baldwin	Drinking Water
Oconee River	Oochee Creek to Long Branch	Laurens, Washington, Wilkinson	Drinking Water
Parks Creek	Headwaters to confluence with North Oconee River	Jackson	Drinking Water
Popes Branch	Headwaters to confluence with Pearson Creek	Putnam	Drinking Water

Source:
GAEPD Rule 391-3-6-.03 Water Use Classifications and Water Quality Standards (2016).
Notes:
[a] Streams and stream reaches not specifically listed are classified as Fishing

3.3.2 Monitored and Impaired Waters

GAEPD publishes a list of streams that do not meet the water quality standards associated with each designated use category. GAEPD monitors streams throughout the State and publishes the list, known as the 303(d) list, every 2 years. In 2014 GAEPD evaluated 1,171 stream miles in the Region; of these, 70 percent were not supporting their designated use. Most of these waters were rated impaired based on biological data (i.e., fish or macroinvertebrates data indicated reduced organism number or diversity) or fecal coliform data. Fecal coliform bacteria are an indicator of the presence of human waste, and high levels indicate potential health risks in waters used for swimming and other recreational purposes. Figure 3-7 shows the locations of the impaired stream segments within the Region based on the 2014 listings, the most recent year for which mapping data were available at the time of plan development. Lakes are also monitored as part of the 303(d) process and are listed as “not supporting” if sample results indicate they do not meet State



water quality standards. A small portion (650 acres of 12,509 acres, or 5 percent) of Lake Sinclair near the intersection of Putnam, Baldwin, and Hancock Counties was included on the impaired streams list, because water temperatures exceeded the State's water quality standard for that parameter.

3.3.3 Conservation Areas

The Georgia Department of Natural Resources (GADNR) Wildlife Resources Division (WRD) identifies waters and watersheds it believes should be given high conservation priority to protect important populations of high priority species and to protect or restore representative aquatic systems throughout Georgia (GADNR, 2015). The high priority waters in the Region are listed in Table 3-3. The streams included on the final priority list are those that are a high priority for restoration, preservation, or other conservation activity; streams that were too degraded were not included in the final list. The streams on the list contain anadromous fish (fish that return to the river where they were born to breed), include rare habitats, or represent the least disturbed aquatic systems within the Region.

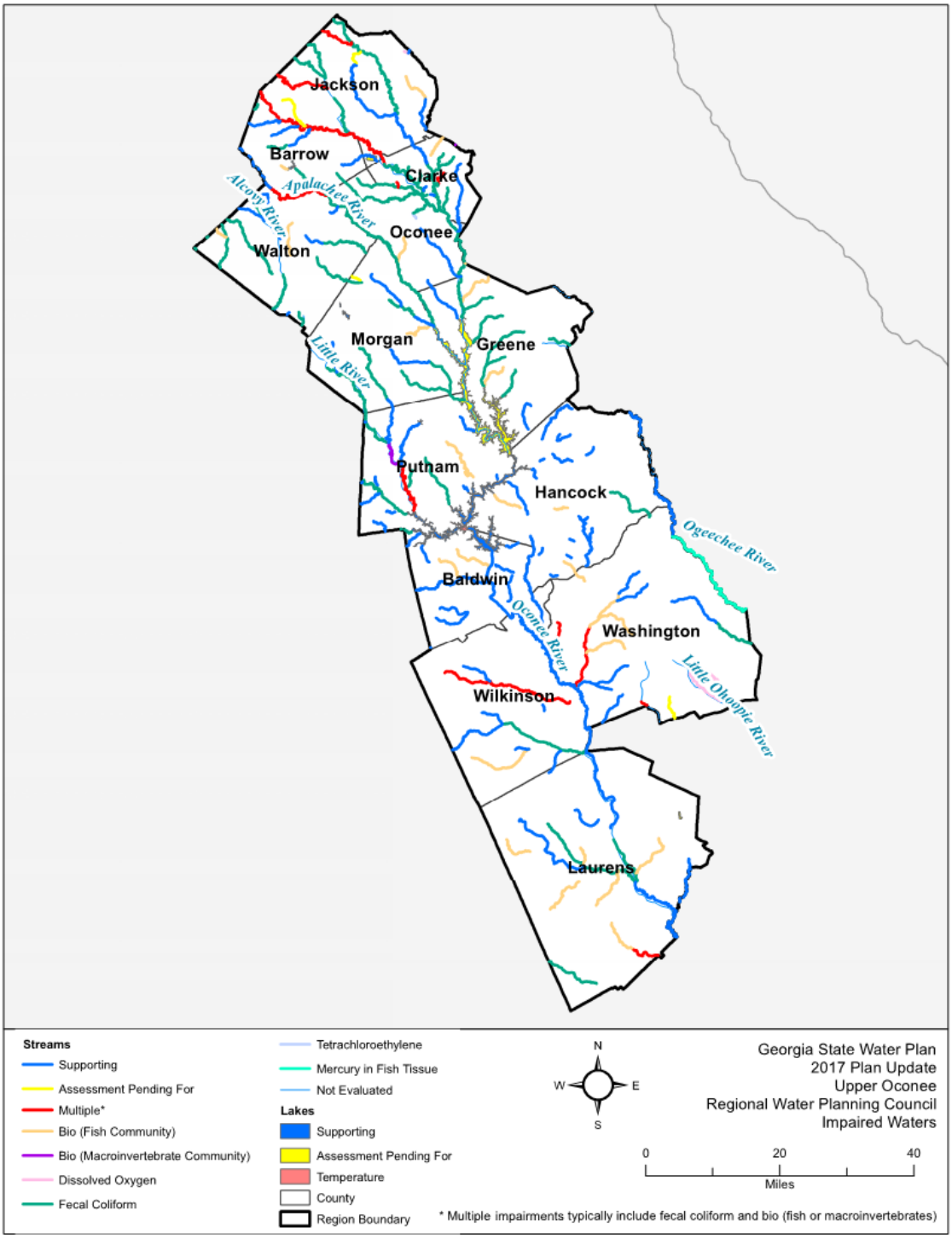
The DNR State Wildlife Action Plan was revised in 2015 and identified priority watersheds (shown in Figure 3-8) due to important coastal habitats, critical habitat or a recent occurrence of a listed species, migratory corridor, or ecological drainage units that were poorly represented in the dataset.

Table 3-3: High Priority Waters in the Upper Oconee Region

Classification	Waters
High Priority Aquatic Community Stream	Alligator Creek, Copeland Creek
High Priority Species Stream	Alcovy River, Little River
High Priority Species and Aquatic Community Streams	Apalachee River, Jacks Creek, Little River, Murder Creek, North Fork Wolf Creek, North Oconee River, Oconee River, Ogeechee River, Shoal Creek, Williamson Swamp Creek

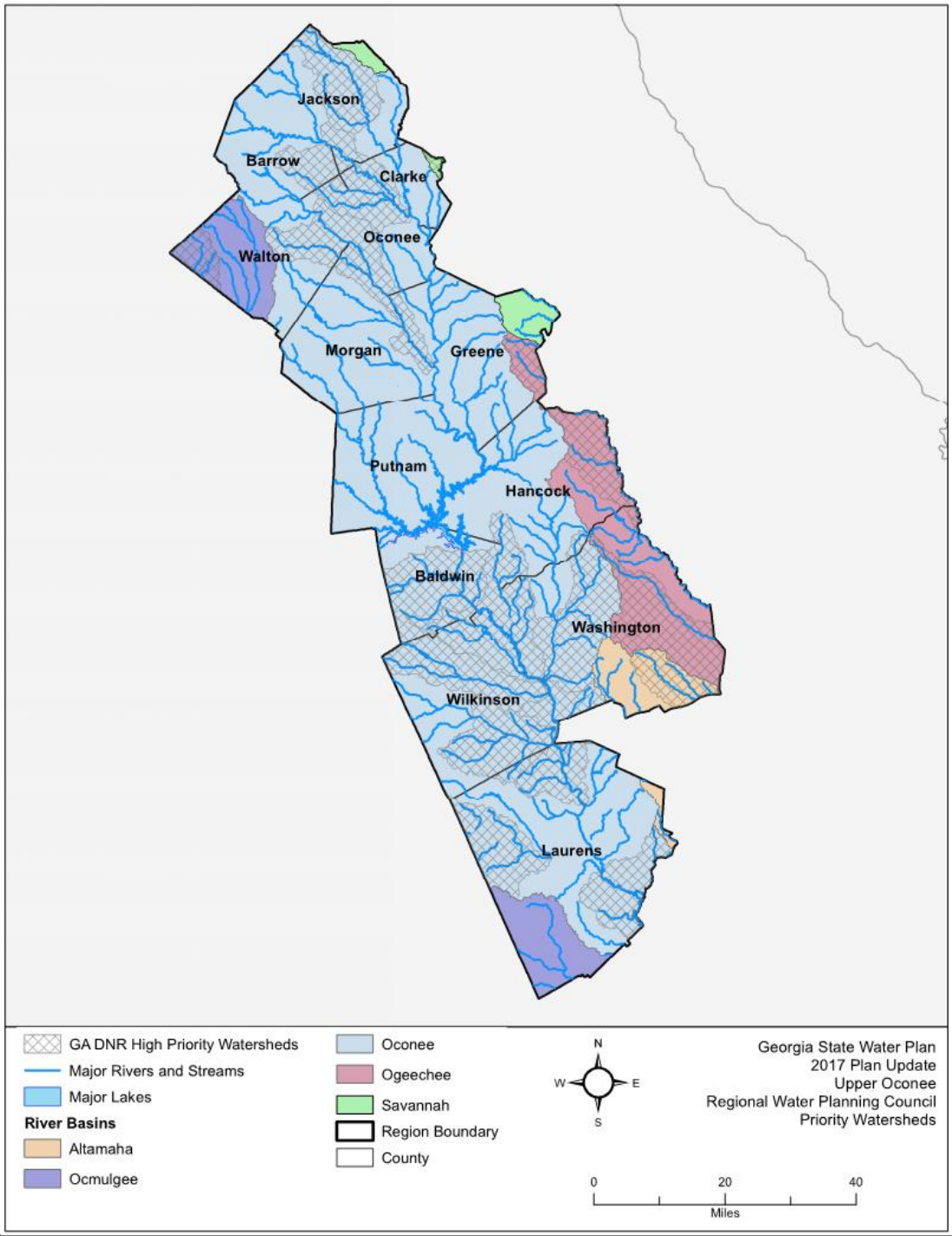
Source: GADNR, 2015.

Figure 3-7: Upper Oconee Region Impaired Waters



Source: GADNR, 2015.

Figure 3-8: High Priority Watersheds



Source: GADNR, 2015.

The Georgia Conservation Lands Database, a product of the Georgia Gap Analysis Program, was compiled to aid a state-wide evaluation of how the distribution of lands managed for protection of biodiversity compares with potential vertebrates habitat. Within the Region, there are over 131,000 acres of protected land managed for conservation purposes, representing 4 percent of the Region's total area. The largest portion of these conservation lands is located in the Oconee National Forest; the B.F. Grant Memorial Forest and the Ogeechee Wildlife Management Area also contain significant conservation acreage.

Within the Region's waters are several species listed by Georgia (but not the Federal government) as threatened or endangered. One fish species—Altamaha Shiner (*Cyprinella xaenura*)—and two invertebrates—Altamaha Arcmussel (*Alasmidonta arcula*) and Oconee Burrowing Crayfish (*Cambarus truncates*) are State-listed as threatened. The fish species Robust Redhorse (*Moxostoma robustum*) is State-listed as endangered. The latter is an important conservation species re-discovered in 1991 in the Oconee River below Sinclair Dam after being presumed extinct for more than 100 years. The Robust Redhorse Conservation Committee was organized soon after the re-discovery with the intention of reestablishing the species in other rivers within the species' former range and to avoid a listing in the future under the Federal Endangered Species Act. The Oconee River contains a remnant gene pool that is considered indispensable to the recovery of this rare species.

3.3.4 Fisheries Resources

The WRD manages the fisheries resources of the Region's two major sport fishing reservoirs, Oconee and Sinclair. Both lakes are routinely stocked with striped bass, and Lake Oconee is also stocked with hybrid striped bass. Largemouth bass, striped bass, hybrid bass, white bass, crappie, sunfish, and catfish are very popular with anglers at Lake Oconee, as are largemouth bass, crappie, catfish, sunfish, and striped bass at Lake Sinclair (GADNR, 2015). The WRD also manages the fisheries of Lake Rutledge in Morgan County, Bear Creek Reservoir in Jackson County, and the Hugh M. Gillis Public Fishing Area in Laurens County.

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Section 4. Forecasting Future Water Resource Needs

Water demand and wastewater flow forecasts and the Resource Assessments described in Section 3 form the foundation for water planning in the Region and serve as the basis for the selection of the MPs discussed in Sections 6 and 7. Any differences between the 2010 USGS data presented in Section 3 and the data in this Section are due to variations in data sources and methodologies.

This Section presents the regional water demand and wastewater flow forecasts from 2015 through 2050 for the four water use sectors: municipal, industrial, agriculture, and energy. Detailed descriptions of the methodology and data used to generate the forecasts can be found in *—Upper Oconee Water and Wastewater Forecasting Technical Memorandum,* available on the Council website.

Section Summary

Total water demands are expected to increase from 166 MGD in 2015 to 226 MGD in 2050. Wastewater flows are likewise anticipated to increase from 141 MGD in 2015 to 205 MGD in 2050.

Forecasted water demand for the energy sector is expected to drop significantly based on Plant Harllee Branch being retired.

Agricultural water demands are also expected to remain relatively constant, while municipal and industrial water demands are projected to increase by 40 percent from 136 MGD in 2015 to 190 MGD in 2050.

4.1 Municipal Forecasts

Municipal water demand and wastewater flow forecasts include water supplied to residences, commercial businesses, small industries, institutions, and military bases. The municipal forecasts are based on county population projections developed by the Governor's Office of Planning and Budget in accordance with State law (O.C.G.A. 45-12-171) and summarized in Table 4-1.

The Region's population is projected to increase from 577,039 in 2015 to 876,884 in 2050, a 52 percent growth increase over this 35-year period. Since the completion of the updated population projections in 2015, a very robust rebound in development has occurred within the Council's Region. While recognizing that the population projections will be updated before the next Plan update process, the Council also notes that in some areas, the future population projections are probably understated.

Table 4-1: Population Projections by County							
County	2015	2020	2030	2040	2050	Difference (2015 to 2050)	% Increase (2015 – 2050)
Baldwin	46,457	47,487	48,902	49,185	48,990	2,533	5%
Barrow	75,869	87,355	114,081	146,904	187,785	111,915	148%
Athens-Clarke	123,489	129,135	139,254	147,208	154,917	31,428	25%
Greene	16,446	16,699	16,681	16,291	16,122	-323	-2%
Hancock	8,630	8,003	6,706	5,455	4,477	-4,153	-48%
Jackson	63,492	69,770	83,313	97,871	114,473	50,982	80%
Laurens	48,543	49,830	51,702	52,653	53,410	4,867	10%
Morgan	18,108	18,927	20,473	21,654	22,877	4,769	26%
Oconee	35,265	38,483	45,904	53,795	62,289	27,024	77%
Putnam	21,533	21,873	22,052	21,831	21,692	159	1%
Walton	89,098	97,786	117,138	138,437	163,301	74,203	83%
Washington	20,686	20,672	20,365	19,774	19,131	-1,555	-8%
Wilkinson	9,423	9,363	8,938	8,231	7,420	-2,004	-21%
TOTAL	**577,039**	**615,383**	**695,509**	**779,290**	**876,884**	**299,845**	**52%**

Source: Georgia Governor's Office of Planning and Budget, 2015.

4.1.1 Municipal Water Demand Forecasts

Regional municipal water demand forecasts were calculated by multiplying the estimated per person (capita) water use for each county by its population. Typically, per capita water use rates differ for public water systems and self-supplied private wells; therefore, the demands are calculated separately and then added together for each county.

Per capita water use rates were initially developed using withdrawal data for 2005 reported by GAEPD and USGS (Fanning and Trent, 2009). With feedback from water providers, adjustments were made to subtract wholesale and industrial water uses where necessary. Self-supplied water users were assumed to use a standard 75 gallons per capita per day, unless stakeholder feedback indicated otherwise. To support this Plan update, GAEPD reviewed withdrawal data and the estimated population served reported by permitted municipal water systems from the years 2010 through 2014. Based on the trends observed from that data, an adjustment factor for each county was developed and applied to the gallons per capita per day values used in 2010 for public-supplied municipal demand. The self-supplied per capita values remained unchanged.

Adjustments also were made to both public and self-supplied water use rates to account for changes in plumbing codes and to reflect water savings over time from the transition to ultra-low flow and high efficiency toilets (maximum 1.6 and 1.28 gallons per flush [gpf], respectively), required by Federal and State laws. These adjustments were based on U.S. Census Bureau housing information and an assumed 2 percent annual replacement rate for plumbing fixtures (older fixtures replaced with new, more efficient ones).

Although the assumed plumbing improvements lowered future per capita water use rates, the total municipal water demand increases significantly from 2015 to 2050 (73.6 MGD to 103.2 MGD) as a result of population growth. Table 4-2 summarizes the municipal water demand forecasts by county for the Region over the planning period.

Table 4-2: Municipal Water Demand Forecasts by County (AAD-MGD)

County	2015	2020	2030	2040	2050
Baldwin	6.3	6.4	6.5	6.4	6.2
Barrow	8.9	10.1	13.0	16.5	20.8
Athens-Clarke	20.6	21.4	22.8	23.7	24.6
Greene	2.3	2.3	2.3	2.2	2.1
Hancock	0.9	0.8	0.7	0.5	0.4
Jackson	6.8	7.5	8.7	10.1	11.6
Laurens	5.7	5.7	5.8	5.8	5.7
Morgan	2.1	2.2	2.3	2.4	2.5
Oconee	3.9	4.2	5.0	5.7	6.5
Putnam	2.3	2.3	2.3	2.2	2.2
Walton	9.9	10.8	12.7	14.8	17.2
Washington	2.8	2.8	2.7	2.6	2.4
Wilkinson	1.1	1.1	1.0	0.9	0.8
TOTAL	**73.6**	**77.7**	**85.8**	**93.9**	**103.2**

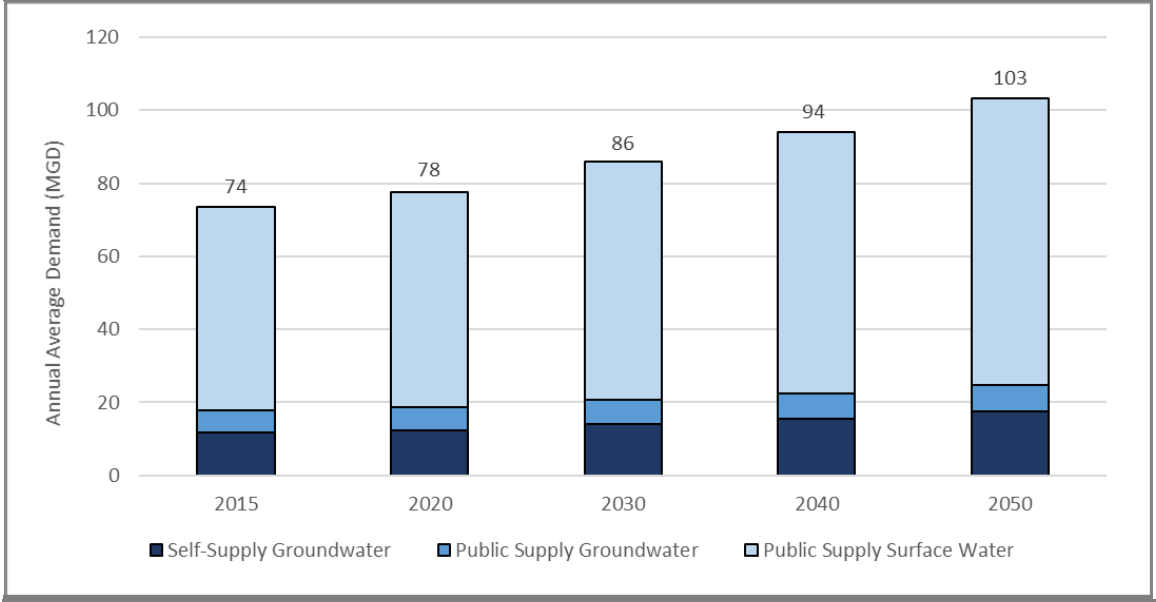
Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (CDM, 2017)

Notes: Municipal water demand forecasts include publicly supplied and self-supplied demands from surface water and groundwater sources.

Additional details regarding development of the municipal water demand forecasts, including the per capita rate and plumbing code adjustment for each county, are provided in the supplemental document *Upper Oconee Water and Wastewater Forecasting Technical Memorandum*, which is available on the Council website.

The demand in the Region for municipal water is forecast to increase from 74 MGD in 2015 to 103 MGD in 2050. Based on existing uses, it is forecast that approximately 75 percent of the municipal water demand in the future will be obtained from surface water sources and 25 percent from groundwater sources; the latter includes private wells (self-supply). Figure 4-1 shows the municipal water demand forecasts for the Region; the demands in this forecast do not include major publicly supplied industries which were included in a separate forecast.

Figure 4-1: Municipal Water Demand Forecast (in AAD-MGD)



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (CDM, 2017)
Notes: Values represent forecasted annual average demand (AAD). Municipal water demands include residential, commercial, small industry, and military bases.

4.1.2 Municipal Wastewater Flow Forecasts

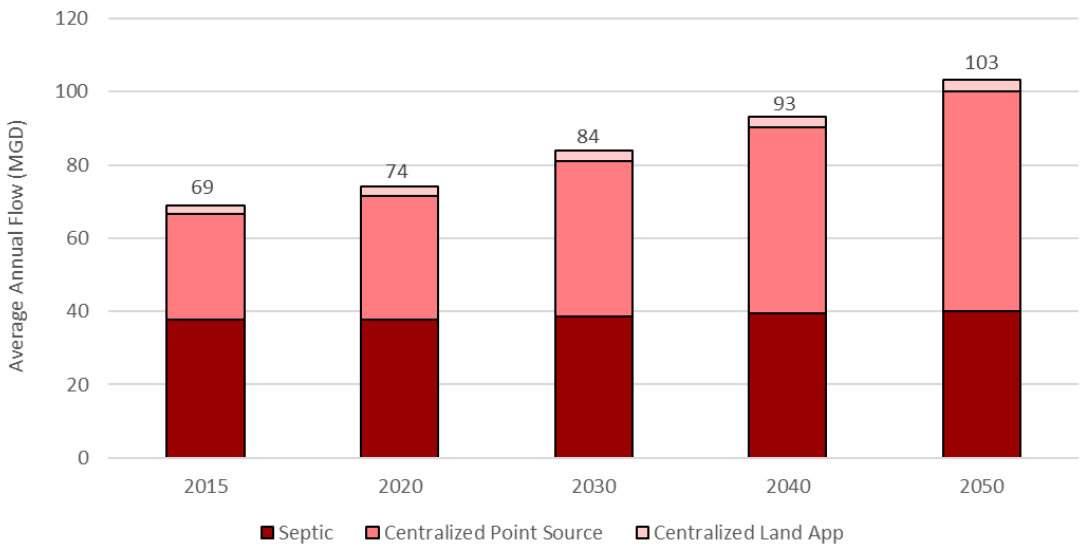
Municipal wastewater flow forecasts were developed to determine the amount of treated wastewater generated and returned to the watershed. In 2010, these forecasts were calculated based on the expected municipal water demand and adjusted for outdoor water use (which does not require wastewater treatment) and inflow and infiltration (I/I). For this plan update, centralized wastewater flows from 2014, including point discharges and land application systems, were analyzed. The sum of the 2014 point discharges per county was adjusted based on any adjustment in the ratio of septic/centralized treatment over time as well as the population projections. Similarly, the sum of 2014 land application system flows by county was adjusted based on the ratio of septic/centralized treatment over time and the population projections.

All privately supplied customers on wells are assumed to use septic systems for wastewater management. The percentage of publicly supplied water customers using sewer and centralized treatment systems was estimated based on available data; the remaining users were assumed to be on septic systems. These percentages were calculated using reported GAEPD and other State of Georgia data, and based on feedback from cities, counties, and water systems. Table 4-3 summarizes municipal wastewater flow forecasts for the Region over the planning period. Figure 4-2 shows the municipal wastewater flow forecasts by disposal type.

Table 4-3: Municipal Wastewater Flow Forecasts by County (AAF-MGD)					
County	**2015**	**2020**	**2030**	**2040**	**2050**
Baldwin	6.8	7.0	7.1	7.1	7.0
Barrow	7.6	8.9	11.7	14.9	18.6
Athens-Clarke	18.2	18.9	20.1	20.9	21.8
Greene	1.7	1.7	1.7	1.7	1.6
Hancock	1.3	1.2	1.0	0.8	0.6
Jackson	5.8	6.4	7.5	8.6	9.9
Laurens	6.5	6.6	6.8	6.9	6.9
Morgan	2.1	2.2	2.5	2.7	2.9
Oconee	3.6	3.9	4.4	5.1	5.9
Putnam	2.0	2.1	2.1	2.1	2.1
Walton	10.3	12.3	16.1	19.6	23.2
Washington	1.9	1.9	1.9	1.8	1.7
Wilkinson	1.1	1.1	1.0	0.9	0.8
TOTAL	**69.0**	**74.2**	**83.9**	**93.2**	**103.2**

Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (CDM, 2017).

Figure 4-2: Municipal Water Use Forecast (in AAF-MGD)



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2017)
Notes: Values represent forecasted annual average flow (AAF).

In summary, municipal wastewater demand in the Region is forecast to increase from 69 MGD in 2015 to 103 MGD in 2050. Of this amount, 3 percent will be treated by LAS and

58 percent by systems with point source discharges. While septic systems currently treat approximately 55 percent of the municipal wastewater generated in the Region, this is expected to decline overall to 39 percent by 2050 as a result of additional areas being served by centralized sewer (point discharge), but remain relatively steady in counties with lower population density. Further details regarding development of the municipal wastewater forecasts and county-specific results are presented in the supplemental document titled *Upper Oconee Demand Forecast Technical Memorandum*, which is available on the Council website.

4.2 Industrial Forecasts

Industrial water demand and wastewater flow forecasts anticipate the future needs of industries that are expected to be the major water users through 2050. Industries use water in their production processes and for sanitation, cooling, and employee use and consumption. The industrial forecasts in this Section are based upon either the rate of growth in employment for specific industrial sectors, the rate of growth in units of production for specific industrial sectors, or other relevant information and data provided by specific industrial water users. The forecast industrial demands include major industrial water users and wastewater generators, many of which supply their own water and/or treat their own wastewater. Many categories of industrial users with very small demands are serviced by municipal water and wastewater systems. The water demands for industries in these categories are included in the municipal forecasts.

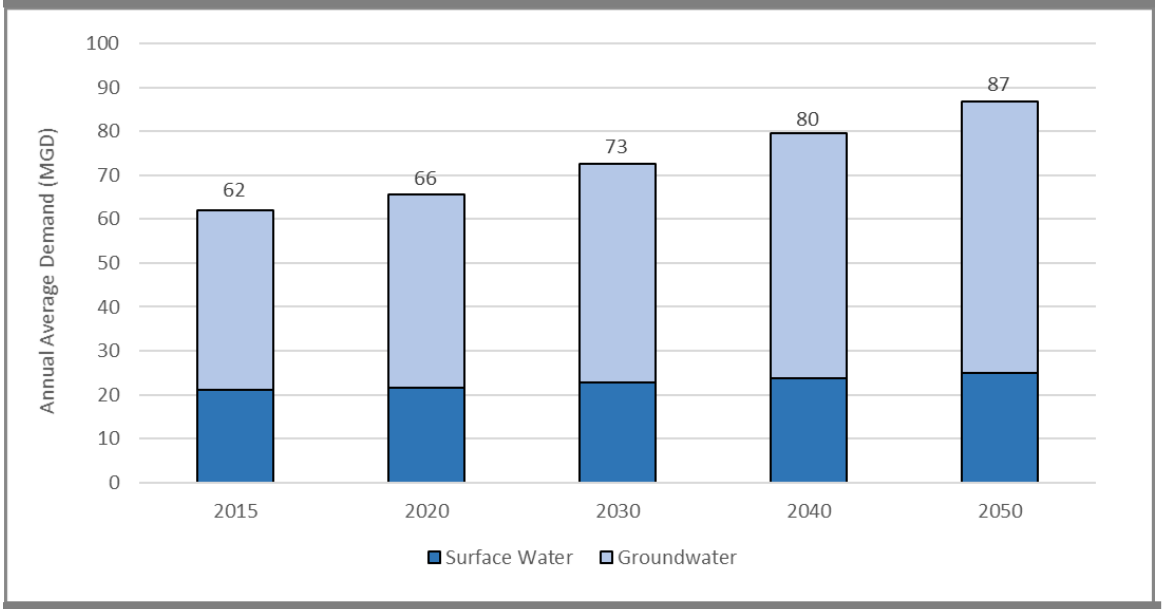
4.2.1 Industrial Water Demand Forecasts

Industrial water demand forecasts were developed using information and data specific to each major water-using industry. For industries for which information was available on water use per unit of production, water forecasts were based on production. For industries for which product-based forecasts were not available, industry-specific workforce projections were assumed to reflect the anticipated growth in water use within the industry. UGA produced industry-specific workforce projections that were used to calculate future water needs for the major water-using industries in the Region. A summary of the employment projections is included in the 2011 supplemental document *Municipal and Industrial Water and Wastewater Forecasting for the Upper Oconee Region*, which is available at the Council website.

The employment projections for the Region indicate that overall employment among major industrial water-using industries will increase over the planning horizon. Decreasing employment is forecast for the apparel industry in the Region, in keeping with trends over the past several decades. However, water demands for this industry were not reduced in the forecast calculations, because water use can change independently of employment change. The mining (kaolin) and paper industries are expected to continue to be the most significant water-using industries in the Region. While the mining industry obtains its water supply primarily from groundwater, the paper industry relies heavily on surface water. Both industries tend to have their own permits for withdrawals. Industrial demand for water in the Region is forecast to increase from 62 MGD in 2015 to 87 MGD in 2050. Based on current proportions, approximately 29 percent of industrial demand in the future will be met by

surface water and 71 percent by groundwater sources. The results of the industrial water demand forecast for the Region are provided in the supplemental document *Upper Oconee Water and Wastewater Forecasting Technical Memorandum* available on the Council website. Figure 4-3 shows the steady increase of industrial water demand in the Region throughout the planning period.

Figure 4-3: Industrial Water Demand Forecast (in AAD-MGD)



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (CDM, 2017)
Notes: Values represent forecasted annual average demand (AAD).

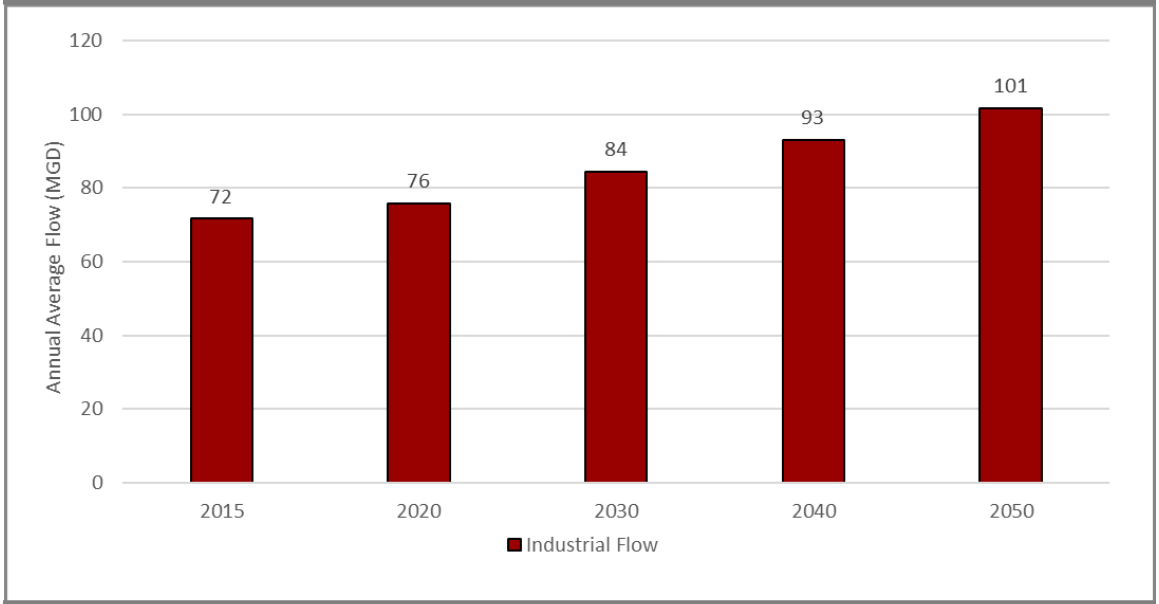
4.2.2 Industrial Wastewater Flow Forecasts

Industrial wastewater flow forecasts were estimated for each sector by multiplying the industrial water demand forecast described in Section 4.2.1 by the ratio of wastewater generated to water used for each industrial sector. Wastewater to water ratios per industry were derived through a state-wide analysis of multiple years of actual annual average water return and withdrawal data for permitted users and information provided by industrial stakeholder groups within a region or industry, as appropriate.

Figure 4-4 shows the industrial wastewater flow forecast, which is projected to increase from 72 MGD in 2015 to 101 MGD in 2050. Based on current proportions, the vast majority of industrial wastewater flow is assumed to be treated by systems with point source discharges. The industrial wastewater flows are greater than the industrial water demands due to the additional water generated by mine dewatering processes.

The results of the forecasting exercise for industrial wastewater flows are provided in the supplemental document *Upper Oconee Demand Forecast Technical Memorandum*, available on the Council website.

Figure 4-4: Industrial Wastewater Flow Forecast (in AAF-MGD)



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2017)
Notes: Values represent forecasted annual average flow (AAF).

4.3 Agricultural Forecasts

Agricultural water use includes irrigation for both crop production and non-crop agricultural water users. The future irrigation needs for crop production were developed by the Georgia Water Planning & Policy Center at Albany State University (GWPPC), with support from the University of Georgia's (UGA) College of Agricultural and Environmental Sciences. Based on the acres irrigated for each crop, these forecasts provide values for irrigation water use as expected for dry, average, and wet years. Each year's projection includes a wet year, a normal year, and a dry year because planning must allow for the range of weather conditions that might reasonably be encountered in future years. Current non-crop (including non-permitted) agricultural water uses, such as water use for nurseries/greenhouses, golf courses, and livestock production, have been compiled by respective industry associations; however, water forecasts for future non-crop agricultural use were not developed because of the lack of available data. For this planning effort, the non-crop water uses are assumed to remain at current levels throughout the planning period. The majority of agricultural water needs are located in Laurens and Washington Counties.

Table 4-4 summarizes agricultural water demands for the Region over the planning period assuming a forecasted dry year condition (75 percent probability level for irrigation). A more

detailed description of the agricultural forecasts is provided in the supplemental document *Upper Oconee Water and Wastewater Forecasting*, available on the Council website.

Table 4-4: Agricultural Water Demand Forecasts by County (AAD-MGD)

County	2015	2020	2030	2040	2050	% Increase (2015 to 2050)
Baldwin	0	0	0	0	0	0%
Barrow	0	0	0	0	0	0%
Athens-Clarke	0.27	0.28	0.29	0.30	0.31	15%
Greene	0	0	0	0	0	0%
Hancock	0.075	0.076	0.077	0.079	0.08	6%
Jackson	0.05	0.05	0.05	0.05	0.06	16%
Laurens	9.1	9.3	9.7	10.0	10.2	12%
Morgan	2.2	2.3	2.4	2.5	2.6	15%
Oconee	3.3	3.4	3.5	3.6	3.8	14%
Putnam	0.25	0.25	0.25	0.24	0.23	-7%
Walton	3.8	3.9	4.1	4.3	4.4	15%
Washington	10.8	11.2	11.9	12.6	13.2	22%
Wilkinson	0.21	0.21	0.21	0.20	0.19	-7%
Total	**30.1**	**30.9**	**32.5**	**33.8**	**35.1**	**16%**

Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (CDM, 2017).
Notes:
Forecasted agricultural crop water demand is based on the dry year (75th percentile scenario).

4.4 Water for Thermoelectric Power Forecasts

Forecasts for future water needs for thermoelectric power production were developed by GAEPD and an ad-hoc group representing Georgia's power industry. Future energy needs are based on projected population. The ad-hoc group helped identify the mix of future fuel sources and potential water needs from various energy generation processes. Certain types of power plants utilize water and others do not. "Waterless" power plants include wind turbine and most solar photovoltaic systems. These plants made up about 1 percent of the total energy generated in 2001 in the United States (USEPA, 2001). Thermoelectric facilities (powered by fossil fuels, nuclear, or geothermal energy) are the primary types of power plants that utilize water for cooling.

Thermoelectric facilities use a significant amount of water, but their water consumption varies depending on the type of cooling used for power generation. The two major types are once-through cooling and closed-loop cooling. Once-through cooling systems use water to condense steam. River or lake water is passed through a heat exchanger to condense steam, the condensed steam is pumped back through the steam cycle, and the cooling water is returned to its source. Although the consumptive water use is minimal at the power plant, the amount of water withdrawn from the river or lake is significant. However, the once-

through cooling water is immediately returned to the source. Closed-loop cooling systems were designed to minimize the amount of water withdrawn and/or to minimize the heat rejected to the receiving river or lake. Closed-loop systems also use water for cooling to condense the steam but the heat is rejected through evaporation in a cooling tower. The cooling water is pumped in a closed loop between the cooling tower and the condenser heat exchanger; makeup water is required to replace the water that evaporates. These systems consumes much more water than once-through systems because the entire energy exchange is through evaporation of the water, but they withdraw less water because less water is needed to make up the evaporated portion.

There are four hydropower facilities in this Region, in Athens-Clarke, Oconee, Washington, and Wilkinson Counties. Consumptive use is negligible for in-stream hydroelectric power generation (Fanning and Trent, 2009). There is only one thermoelectric facility in the Region, Plant Harlee Branch, located in Putnam County which is currently being retired and is not included in the forecast after 2015. The Region's total water withdrawal need for the energy sector and the respective consumptive water need is provided in Table 4-5.

Table 4-5: Energy Sector Water Demand Forecast (AAD-MGD)

Demand Type	2015	2020	2030	2040	2050
Withdrawals	669	0.58[a]	0.66	0.75	0.81
Consumption	0.46	0.49	0.56	0.63	0.69

[a]Plant Branch is undergoing decommissioning currently, and is not included in the forecast from 2020 through 2050. This is the cause of the sharp decline in water withdrawn from 2015 to 2020.

Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (CDM, 2017).

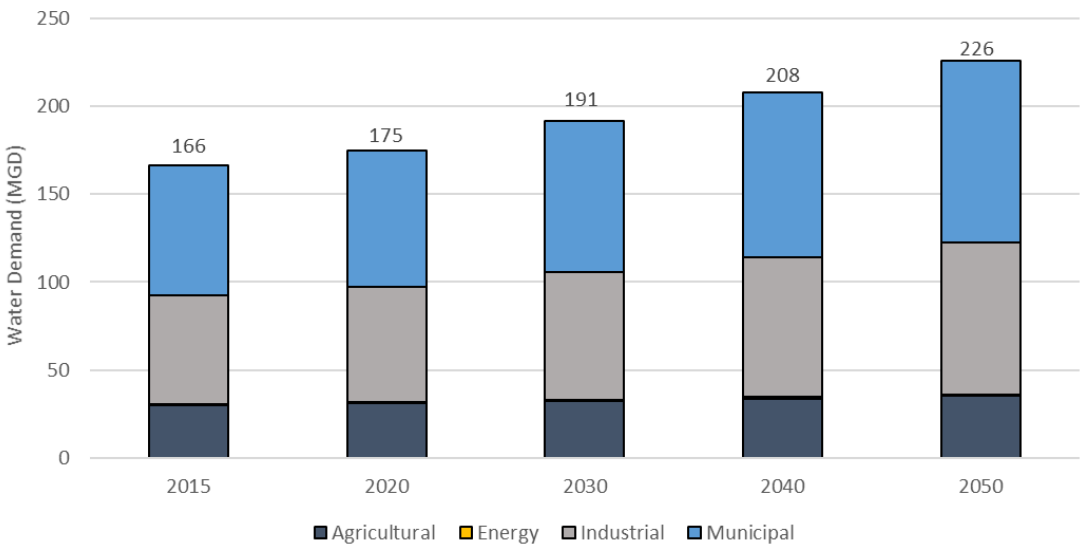
The process of generating the forecasted water demands and wastewater returns for thermoelectric power generation is documented in the supplemental document *Update of GA Energy Needs & Generating Facilities*, available on the Council website.

4.5 Total Water Demand and Wastewater Flow Forecasts

The water needs of the region are projected to increase from 166 MGD in 2015 to 226 MGD by 2050, as shown in Figure 4-5. Municipal water demand is current the greatest demand, followed closely by industrial water demand and then agricultural water demand. Consumptive energy demand in the region is currently minimal.

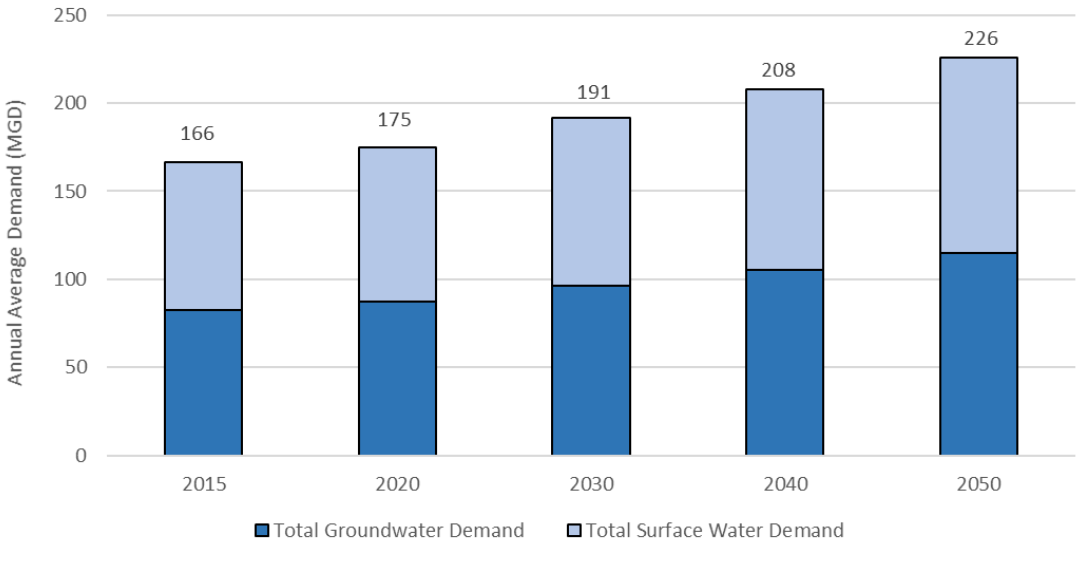
Figure 4-6 shows the total water demand forecast by source. Surface water and groundwater demand in the region are currently evenly split and projected to increase proportionally into the future.

Figure 4-5: Water Demand Forecast per Sector



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2017)
Notes: Values represent forecasted annual average demand (AAD).

Figure 4-6: Total Water Demand Forecast (AAD-MGD)

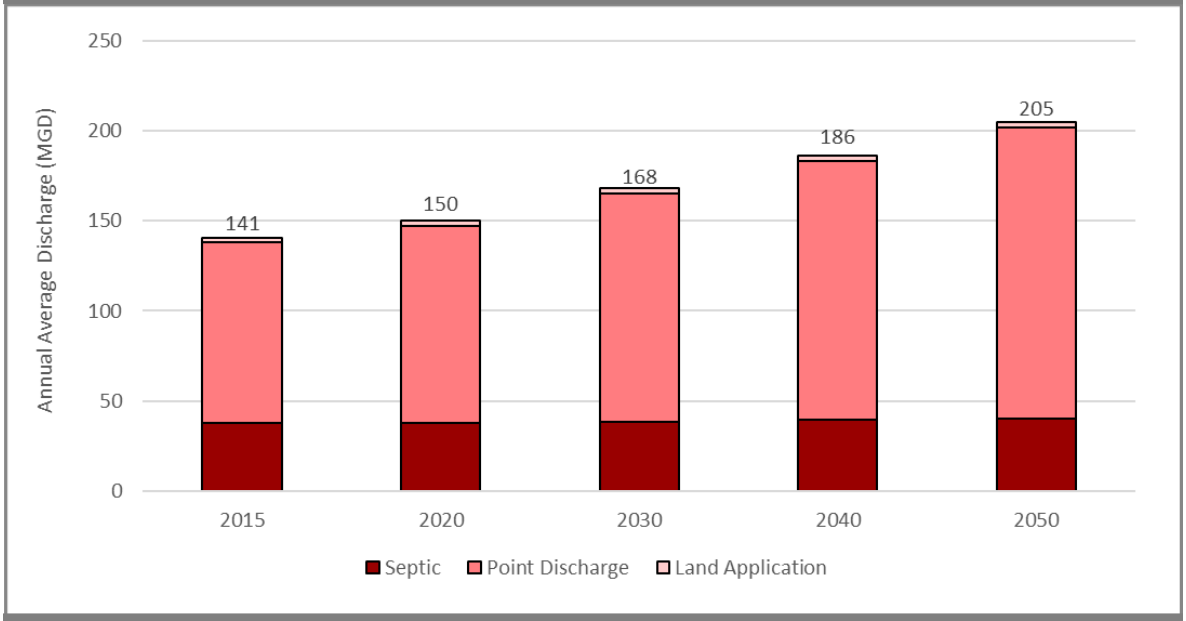


Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (2017)
Notes: Values represent forecasted annual average demand (AAD).

Wastewater flows by treatment and disposal type (point discharge, Land Application System (LAS), or onsite septic) are illustrated for 2015 through 2050 in Figure 4-7. Point discharges of municipal and industrial wastewater are projected to make up 79 percent of the total, land application 2 percent, and septic systems 19 percent of the future wastewater flow forecasts in 2050.

The increase in wastewater quantity is particularly significant in fast-growing counties such as Barrow, Jackson, Oconee, and Walton. Strategic wastewater management will be essential to protecting the Region's surface water quality.

Figure 4-7: Total Wastewater Flow Forecast (AAF-MGD)



Source: Upper Oconee Water and Wastewater Forecasting Technical Memorandum (CDM, 2017)
Notes: Values represent forecasted annual average flow (AAF).

Section 5. Comparison of Available Water Resource Capacities and Future Needs

Section Summary

For groundwater availability, no resource shortfalls are expected to occur over the planning horizon.

Increased demand in the region may add to a modeled surface water gap downstream of the region at the Eden planning node on the Ogeechee River.

Potential needs in available facilities or infrastructure capacity include water infrastructure needs in Barrow, and Oconee Counties. Potential shortages in wastewater infrastructure were identified in Walton County.

Results indicate potential nutrient issues in Lake Oconee and Lake Sinclair without implementation of Management Practices to reduce nutrient loadings.

This Section compares the water demand and wastewater flow forecasts (Section 4) with the Resource Assessments, (Section 3), providing the basis for selecting the water management practices discussed in Sections 6 and 7. Areas where future demands exceed the estimated capacity of the resource for groundwater, surface water availability, and surface water quality (the assimilative capacity of the waterway) have a gap or shortage that will be addressed through the management practices described in Section 6.2. This section summarizes the potential gaps and shortages, also referred to as water resource management issues, for the Upper Oconee Region.

5.1 Groundwater Availability Comparisons

There are three priority aquifers within the Upper Oconee Region: north of the Fall Line, in the Piedmont Physiographic Province, the Crystalline rock aquifer system is located beneath Barrow, Jackson, Walton, Oconee, Morgan, Greene, Putnam, Baldwin, and Hancock Counties. South of the Fall Line, the Cretaceous aquifer system is located beneath Wilkinson, Washington, and Laurens Counties in Georgia's Coastal Plain. The Floridan aquifer is located south of the portions of the Region within the Eastern Coastal Plain. Only a small portion of the Region includes the Floridan aquifer.

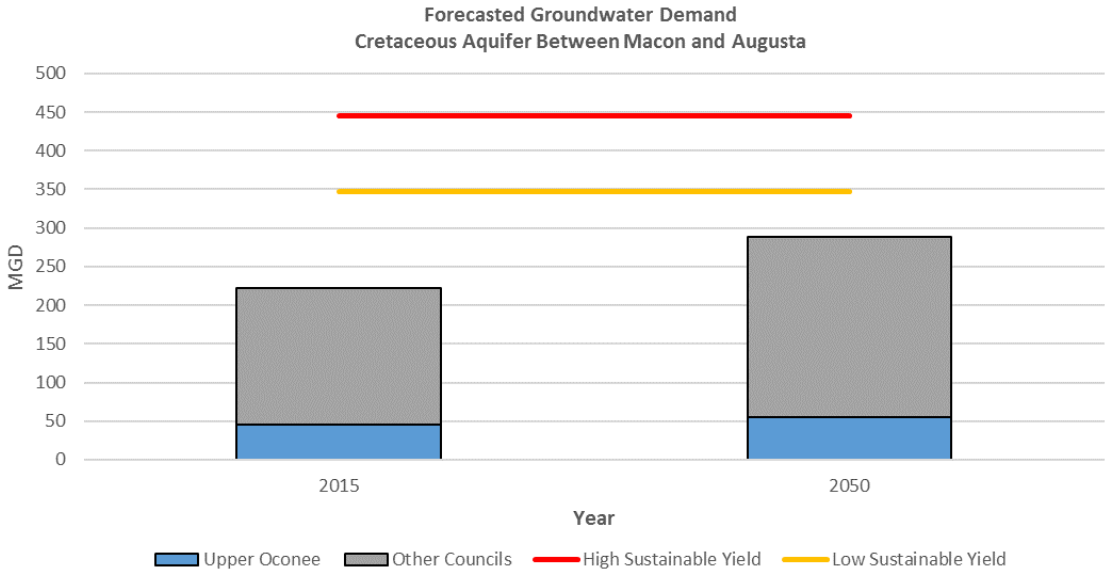
The results from the *Groundwater Availability Assessment* estimated the potential range of sustainable yield for each of the three priority aquifers in the Region based on the models developed for the respective aquifers. The sustainable yields were then compared to the projected 2050 groundwater demands across Water Planning Regions. The assessment concluded that supplies from the Crystalline-Rock, Cretaceous, and Floridan aquifers are generally sufficient in meeting the forecasted groundwater demand from areas with access to these aquifers.

Crystalline-Rock Aquifer – Many communities in the upper portion of the Region use groundwater from the Crystalline-Rock aquifer to meet local needs or supplement their surface water supply sources. In addition, groundwater is drawn from this aquifer for self-supply wells in the region. A small portion of the Crystalline-Rock aquifer within the Upper Oconee Region was modeled as part of the *Groundwater Availability Assessment* giving a

low range normalized sustainable yield of 0.01 MGD per square mile of area. Using this conservative value for planning would give an estimated sustainable yield for the Upper Oconee area overlaying the Crystalline-Rock aquifer of about 30 MGD on an annual average basis. Total estimated demands in this same area are 17.5 MGD in 2015 increasing to 26.1 MGD in 2050.

Cretaceous Aquifer – The Cretaceous aquifer is a significant water source in the Upper Oconee Region and in other water planning regions in Georgia. The sustainable yield for the prioritized aquifer units modeled is estimated to range from 347 to 445 MGD. Projections for water use from the multiple regions with access to this aquifer show that future demand within the modeled area is not projected to exceed the sustainable yield in future years (Figure 5-1). The demand estimates include 75th percentile agricultural demands representing dry year conditions. Because the Resource Assessment modeling is not specific to individual planning regions, site-specific studies would likely be required to determine the sustainable yield of this aquifer in any particular local area.

Figure 5-1: Cretaceous Aquifer Demand vs. Estimated Yield



Source:
Supplemental Modeling conducted for the Cretaceous and Claiborne Aquifers, 2011
Upper Oconee Updated Demand Forecast Technical Memorandum, 2017

Floridan Aquifer – The total estimated range of sustainable yield for the Floridan aquifer in the South-Central Georgia and Eastern Coastal Plain modeled portions of the aquifer is higher than forecasted 2050 groundwater demands from regions with access to this aquifer. The projected water supply need from this aquifer for the Upper Oconee Region is approximately 14 MGD in 2050 from the southern portion of the region (Laurens, Washington, and Wilkinson counties utilize this aquifer). The modeling results indicate that significant additional resources are available from the Floridan aquifer.

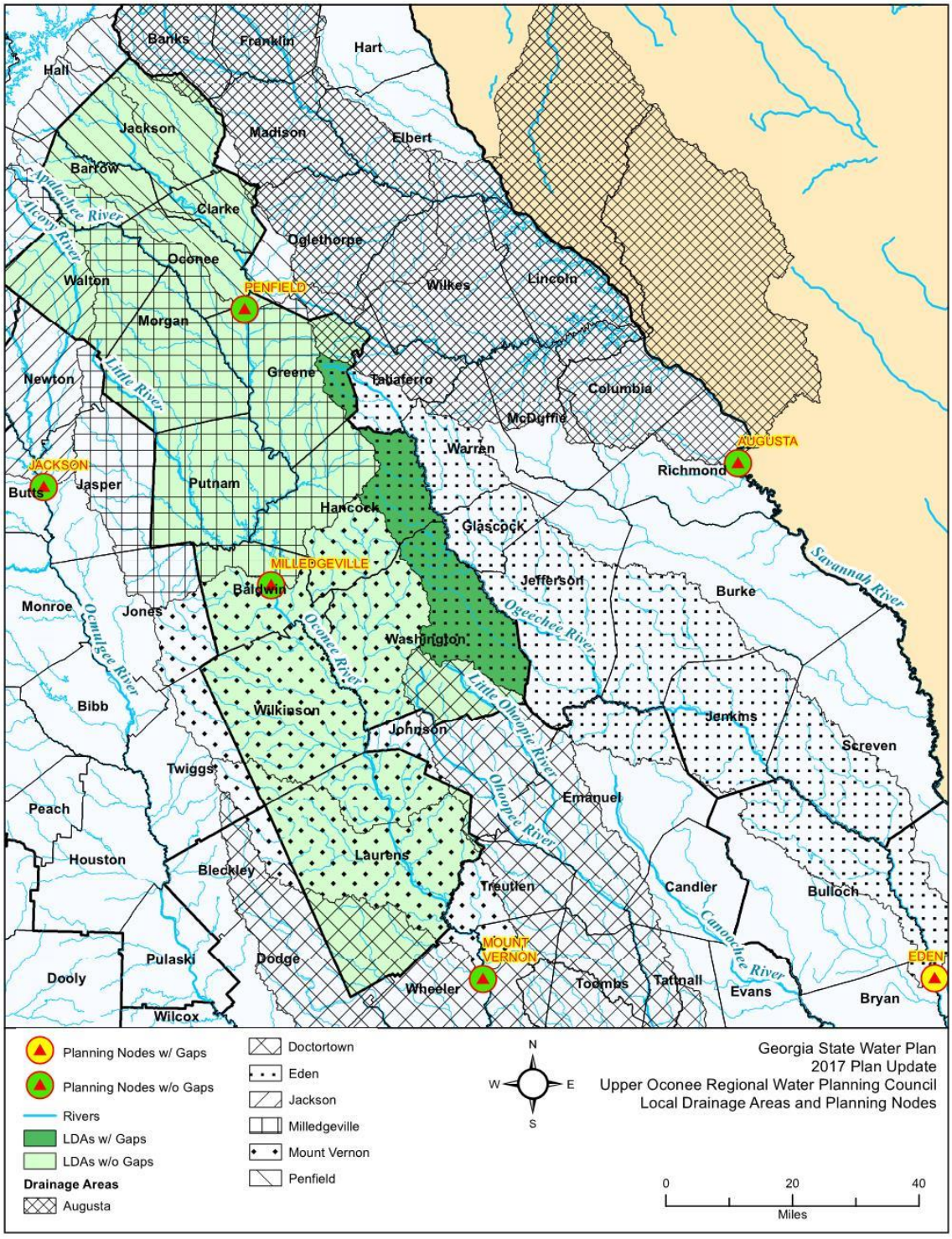
5.2 Surface Water Availability Comparisons

The evaluation of surface water availability is based on the results of the *Surface Water Availability Assessment* (GAEPD, 2017) and the projected surface water demands for 2050. For modeling purposes, the basin was divided into sub-basins with results summarized at individual planning nodes. The location of the planning nodes, local drainage areas (LDAs), and projected water availability gaps by planning node are summarized in Figure 5-2. The darker shading within the Upper Oconee Region indicates the areas that drain to a planning node with potential surface water gaps. The only planning node with a modeled surface water gap that has a portion of its drainage area within the Upper Oconee region is the Eden node along the Ogeechee River. An earlier version of the analysis identified the Penfield node as potentially having a gap, but following incorporation of several upstream water supply reservoirs, potential gaps were no longer identified at the Penfield node.

The Water Quantity Resource Assessment modeling evaluated streamflows under future demand conditions and compared them to a low flow threshold. In unregulated portions of the basin, upstream of the Penfield node, the low flow threshold is defined by the State's Interim Instream Flow Protection Policy, which calls for the protection of monthly 7Q10 or natural inflow, whichever is lower. (The 7Q10 flow is the seven-day, consecutive low flow with a 10-year return frequency; the lowest stream flow for 7 consecutive days that would be expected to occur once in 10 years).

Milledgeville and Mount Vernon are both regulated nodes at which FERC specifies an explicit flow requirement. The Resource Assessment estimates whether or not a potential gap in stream flow or storage exists; if so, it can be compared to future demands to understand potential future gaps by node. According to the future surface water demand projections by county discussed in Section 4, most future demands are projected to occur in the upper portion of the basin (i.e., Jackson, Barrow, Athens-Clarke, Oconee, and Walton Counties).

Figure 5-2: 2050 Surface Water Gap Summary



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The surface water availability assessment predicted that the low flow threshold cannot be maintained at all times while meeting the forecasted 2050 demands at the Eden node. Table 5-1 provides a summary of the modeled potential surface water gaps at the Eden node.

Table 5-1: Summary of Modeled Gap Analysis at Eden Node

Period	Length of Gap (% of time)	Average Gap	Long-term Average Flow	Maximum 1-Day Gap	Corresponding Flow Regime
Current	6	16 cfs (10 MGD)	2,207 cfs (1426 MGD)	35 cfs (23 MGD)	139 cfs (90 MGD)
2050	3	24 cfs (16 MGD)	2,213 cfs (1430 MGD)	47 cfs (30 MGD)	102 cfs (66 MGD)

Source: Surface Water Availability Assessment (GAEPD, 2017b)

Surface water gaps are driven by both net consumption (withdrawal minus returns) and year to year variations in river flows. In wet years, the region is likely to not experience any potential gaps due to off-stream uses and instream needs. In dry years, the potential gaps are likely to be more severe. In order to better assess these potential gaps and to better understand the types of management practices that may be required, a more detailed quantification of the frequency and severity of potential gaps was completed.

The quantification and frequency of potential gaps is especially relevant when selecting water management practices. For example, if the preferred management practice is to replace surface water diversions with groundwater withdrawals, it is important to know how much flow should be generated and for what length of time. This process will in turn dictate the number and size of wells needed to generate the flow. If a reservoir is the preferred practice, then one needs to know the largest volume of storage that may be needed because stream flow needs can then be addressed by controlling the rate of flow released from the reservoir. In addition, since the largest potential gaps occur less frequently, there are important cost-benefit considerations associated with addressing the largest and more infrequent potential gaps. The quantification and frequency of the modeled gaps is provided in Table 5-2. It is important to note that the less severe and more frequent gaps (1 to 7 day and 8 to 14 day potential gaps events) are those that can most likely be addressed by management practices. The more infrequent and severe gaps are indicative of drought conditions and will most likely be addressed through drought management measures implemented by GAEPD and users in the Region.

Table 5-2: Characteristics of Modeled 2050 Potential Surface Water Gaps						
Gap Event Duration	Number of Gap Events (% of Total Gap Events)[1]		Total Gap Days (% of Total Days)[2]		Average Daily Flow Deficit per Event	Average Cumulative Flow Deficit per Event
Eden Node						
1-7 days	44	(61.1%)	178	(0.6%)	11 cfs (7 MGD)	52 cfsd (34 MG)
8-14 days	12	(16.7%)	114	(0.4%)	15 cfs (10 MGD)	150 cfsd (98 MG)
15-30 days	10	(13.9%)	222	(0.8%)	29 cfs (19 MGD)	633 cfsd (411 MG)
>30 days	6	(8.3%)	388	(1.4%)	28 cfs (18 MGD)	1,795 cfsd (1,167 MG)
Totals	72	(100.0%)	902	(3.3%)		

Source: Surface Water Availability Assessment (GAEPD, 2017b)

[1] The total number of modeled gap events is presented for each duration range, as well as the percentage in that duration range to the total number of all modeled gap events.

[2] The total number of days within the modeling period (1939-2013) in which a potential gap occurred is presented, as well as the percentage of that total relative to the total number of days analyzed in the modeling period.

The projected changed use of surface water for the counties within the Upper Oconee Region that have potential current and future modeled gaps are shown in Table 5-3. Since there are current modeled gaps at the referenced planning nodes, any development of additional surface water to meet projected needs should be done in a manner that does not increase potential gaps. While Greene County also has a portion of its area in the drainage basin of the Eden planning node, there are currently no agricultural water demands (or other surface water uses drawing from the Eden node drainage area) forecasted for that county.

Table 5-3: 2050 Increased Annual Average Surface Water Demand within Potential Gap Areas			
County	Planning Node with Gap	Change in Agricultural Demands by 2050[1] (MGD)	Change in Agricultural Demand by 2050[1] (cfs)
Hancock	Eden	0.001	0.002
Washington	Eden	0.38	0.58

[1]All surface water demands within drainage areas with potential gaps are agricultural

At the Milledgeville node, the modeling indicates that there would not be a shortage in meeting future demands, but the model assumes that the potential storage available in Lakes Oconee and Sinclair could be used for water supply (Table 5-4). The slight increase in available storage is due to the forecasted increase in return flows in this sub-basin in 2050. Both of these reservoirs are owned and operated by Georgia Power, and the storage in these lakes is reserved for hydropower generation. Any future use of this storage capacity for water supply purposes would have to be negotiated and approved by Georgia Power,

GAEPD and FERC. Similarly, at the Mount Vernon node, there would be no shortages in meeting future surface water needs based on the existing storage in the basin. Evaluations of potential needs for surface water storage take into consideration the willingness of Georgia Power to re-allocate storage in its reservoirs.

Table 5-4: Summary of Milledgeville and Mount Vernon Regulated Nodes[1]

Node	Current Conditions		Future (2050) Conditions	
	Minimum Reservoir Storage (acre-feet)	Minimum Reservoir Storage (%)	Minimum Reservoir Storage (acre-feet)	Minimum Reservoir Storage (%)
Milledgeville	66,588	32%	77,306	37%
Mount Vernon	66,588	32%	77,306	37%

[1]The summary information at both nodes reflects combined storage for Lakes Oconee and Sinclair.
Source: Surface Water Availability Resource Assessment (GAEPD, 2017b)

Table 5-5: Permitted Municipal Water Withdrawal Limits vs. 2050 Forecasted Demands (MGD) [1,2]

County	Current Permitted Water Withdrawals [3]	Projected 2015 Water Demand [3]	Projected 2050 Water Demand [3]	2050 Permitted Capacity Need [4]
Baldwin	15.4	6.3	6.2	-
Barrow	17.0	6.2	14.7	-
Athens-Clarke	67.0	20.6	24.6	-
Greene	6.4	2.0	1.9	-
Hancock	1.30	0.7	0.3	-
Jackson	25.9	6.6	11.2	-
Laurens	8.2	4.0	4.1	-
Morgan	3.5	1.4	1.6	-
Oconee	21.7	2.9	4.8	-
Putnam	8.6	1.7	1.6	-
Walton	52.5	6.8	12.0	-
Washington	4.4	2.1	1.9	-
Wilkinson	0.9	0.9	0.6	-

[1] Permitted municipal water withdrawals and projected water demands include publicly supplied surface water and groundwater. It also includes industrial facilities that purchase their water from municipal sources.
[2] It does not include self-supply.
[3] All units shown are MGD Average Annual Demand (AAD)
[4] Analysis does not account for demands in one county that may be met by permits from another county
Source: GAEPD Permit Data

In addition to the surface water availability assessment modeling, the existing permitted water withdrawals (surface water and groundwater) and future demands were compared to identify potential needs in available facilities or infrastructure (Table 5-5). Across the Region, all future needs can be met through current permitted water withdrawal limits. Estimates were calculated by comparing the permitted monthly average withdrawal limit with the forecast annual average demands. Therefore, these estimates are only an indicator of potential future needs in permitted capacity and indicate areas where continued localized facility planning will be needed, but are useful for regional planning.

5.3 Surface Water Quality Comparisons (Assimilative Capacity)

This section summarizes the results of the *Assimilative Capacity Resource Assessment,* (GAEPD, 2017a) and the water quality gaps that the Upper Oconee Region may face, based on projected 2050 wastewater flows and assumptions.

5.3.1 Assimilative Capacity Assessments

The Assimilative Capacity Resource Assessment drew upon water quality modeling tools to estimate the ability of streams and estuaries to assimilate pollutants under current and future conditions. Modeling focused on instream dissolved oxygen (DO) and incorporated all municipal and industrial wastewater facilities operating at their full permitted discharge levels (flow and effluent discharge limits as of 2014). The results of the DO modeling at current permitted conditions are presented in Figure 5-3 and Table 5-6 for the Upper Oconee Region, which includes portions of the Altamaha, Ocmulgee, Oconee, Ogeechee, and Savannah River basins. The results show the modeled effects of oxygen-demanding compounds in wastewater and other factors on instream DO levels. A stream segment with “none or exceeded” available assimilative capacity (denoted as red lines in Figure 5-3) have estimated instream DO levels that are at or below the DO water quality criteria and therefore indicate conditions of no available assimilative capacity or exceeded assimilative capacity. It is important to note that an exceedance of DO assimilative capacity on a stream segment could be the result of a point source discharge, non-point source loading, or a naturally low instream DO condition. Reaches within the Upper Oconee Region that have exceeded their full assimilative capacity under the current conditions assessment include:

- Alligator Creek in the Ocmulgee Basin; and
- Glady Creek, Little Commissioner Creek, Turkey Creek, an unnamed trib to Big Indian Creek, and portions of the main stem of the Oconee River in the Oconee Basin.

Table 5-6: Permitted Assimilative Capacity for DO in Upper-Oconee Planning Council							
Basin	Available Assimilative Capacity (Total Mileage)						Total Modeled Basin in Council
	Very Good (≥1.0 mg/L)	Good (0.5 to <1.0 mg/L)	Moderate (0.2 to <0.5 mg/L)	Limited (>0.0 to <0.2 mg/L)	None or Exceeded (<0.0 mg/L)	Unmodeled	
Altamaha	7	8	4	6	0	0	25
Ocmulgee	38	4	1	2	9	0	54
Oconee	371	148	46	21	35	0	621
Ogeechee	29	30	52	5	0	0	116
Savannah	1	0	0	0	0	0	1
Source: Assimilative Capacity Resource Assessment (GAEPD, 2017c)							

Based on the results shown in Figure 5-3, GAEPD also conducted modeling under future conditions. In order to address areas of limited or no assimilative capacity for DO, GAEPD incorporated some assumptions regarding future (2050) permitted flows and modifications to permit effluent limits. Since GAEPD cannot issue permits that will violate water quality standards, GAEPD will continue to evaluate and modify future permit requests and adjust permit limits to avoid potential DO violations. Figure 5-4 shows the assimilative capacity at assumed future (2050) permitted flows and effluent limits. More information regarding the type of assumptions made under future conditions modeling is provided in the *Assimilative Capacity Resource Assessment.*

Figure 5-3: Results of Assimilative Capacity Assessment – DO at Current Permitted Conditions

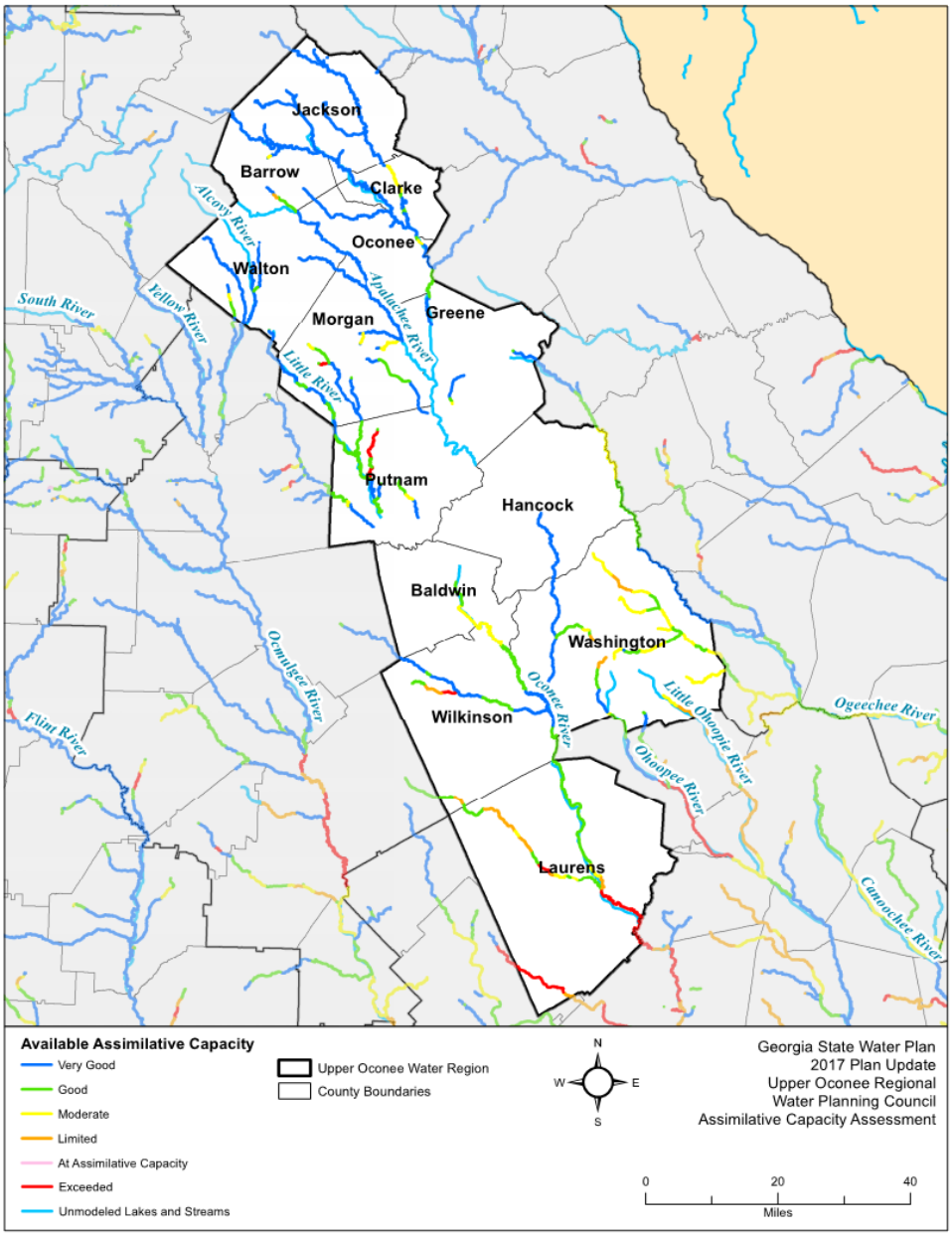
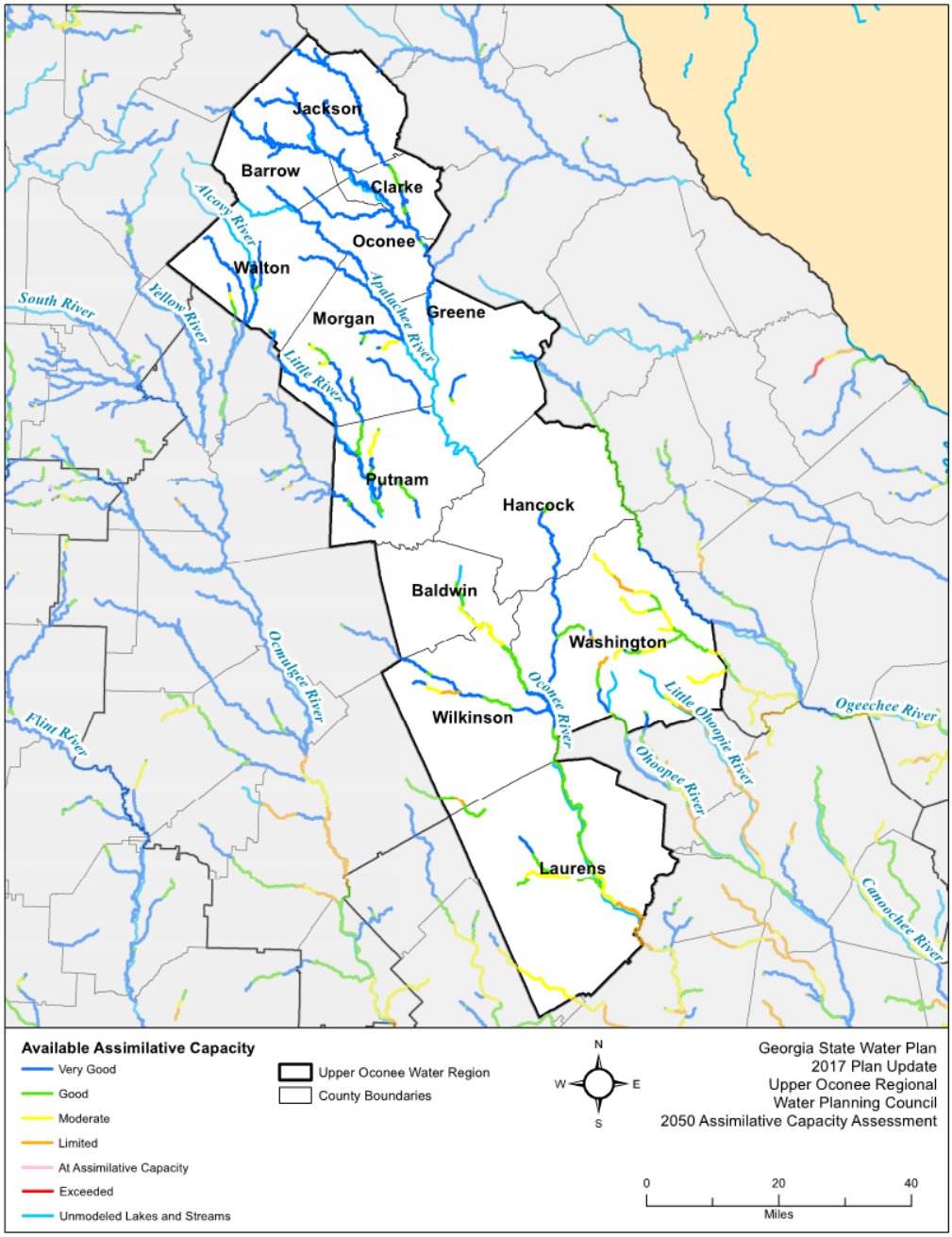


Figure 5-4: Results of Assimilative Capacity Assessment – DO at Assumed Future (2050) Permitted Conditions



5.3.2 Nutrient Loadings

Watershed-based modeling to evaluate nutrient loadings under 2050 conditions was completed only for those watersheds contributing to the areas upstream of Lakes Oconee and Sinclair. In Georgia, currently there are six lakes that have lake standards and they are West Point, Walter F. George, Jackson, Lanier, Allatoona and Carters.

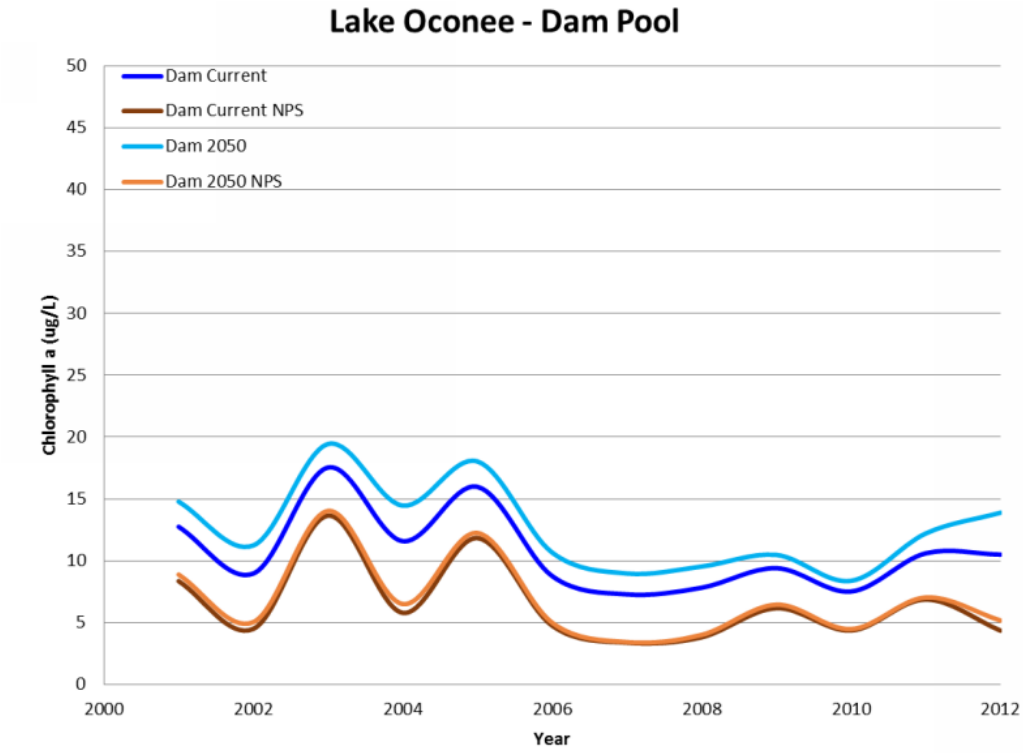
Lake Jackson's chlorophyll a standard is 20 ug/L at Midlake. As part of Georgia's Numeric Nutrient Criteria Development plan, GAEPD intends to develop lake specific water quality criteria for 28 additional lakes in Georgia, and currently are in the process of developing lake criteria for Lake Oconee and Lake Sinclair.

Modeling assumptions included no changes to the total P limits or concentrations for all facilities that have permit limits. For major facilities with discharges greater than 1 MGD that currently don't have Total P limits, a Total P concentration of 1 mg/L for both current and future model runs was assumed. For minor facilities with discharges less than 1 MGD, the current discharge had a Total P concentration of 4 mg/L and all future discharges had a concentration of 8.34 mg/L above a flow of 0.02 MGD. Below this flow the Total P concentration would be 5 mg/L.

Modeling results (Figure 5-5) indicate that at the Lake Oconee Dam Pool we see the chlorophyll level increase slightly due to land use changes and quite a bit due to increase in the loads from major point sources. Results are similar but more dramatic for the portion of the Lake near Hwy 44.

Modeling completed for Lake Sinclair (Figure 5-6) indicates that the chlorophyll a levels also are projected to increase between current and 2050 conditions. Although nutrient standards are not currently in place for waters within the Region, GAEPD is developing nutrient standards based on mandates from the U.S. Environmental Protection Agency. Therefore, nutrient standards for waters within the Region are likely in the future. Management practices for nutrient reductions from both point and nonpoint sources will be needed in order for waters to meet these new standards and to maintain conditions in Lakes Oconee and Sinclair.

Figure 5-5: Growing Season Median Chlorophyll-a Concentration – Lake Oconee



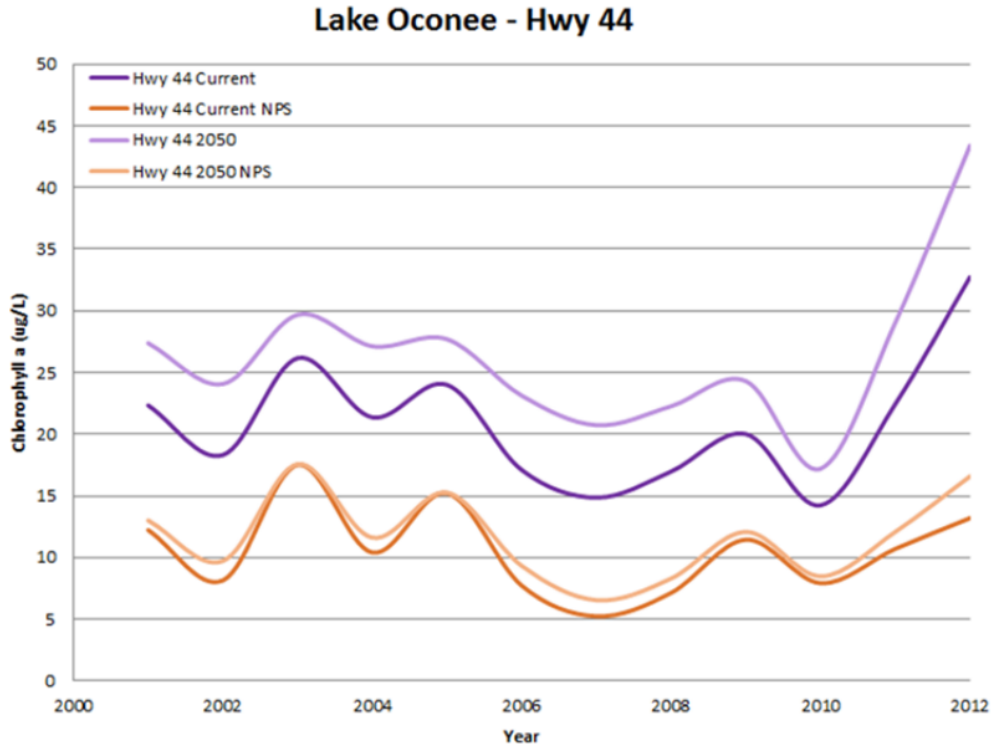
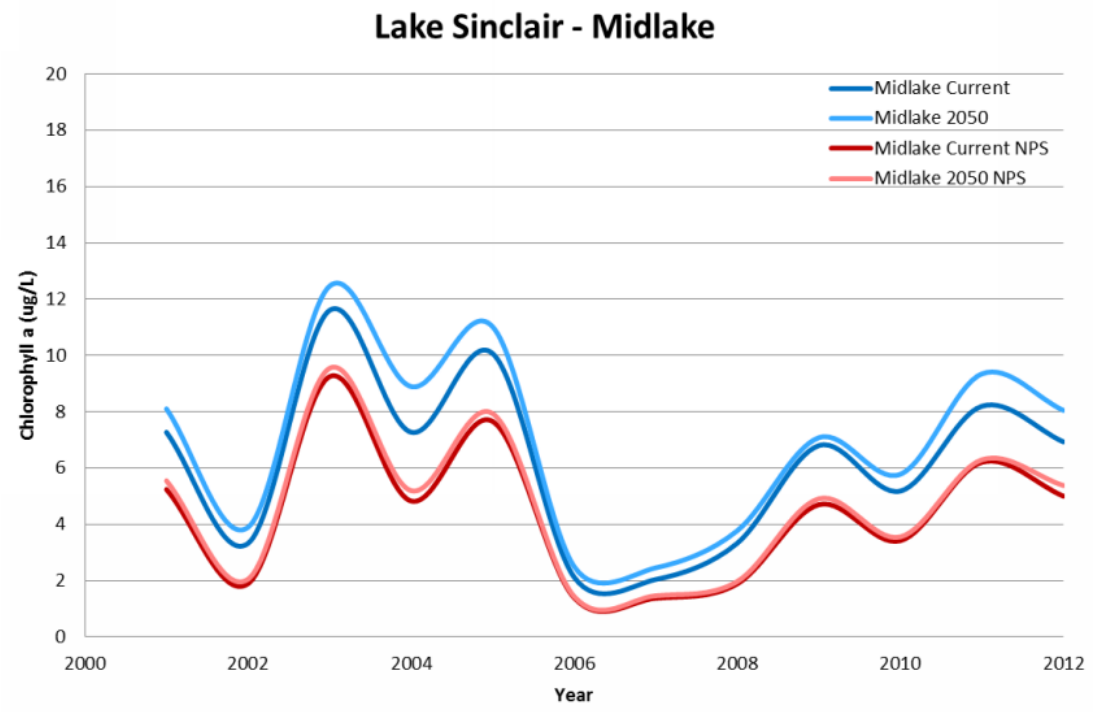
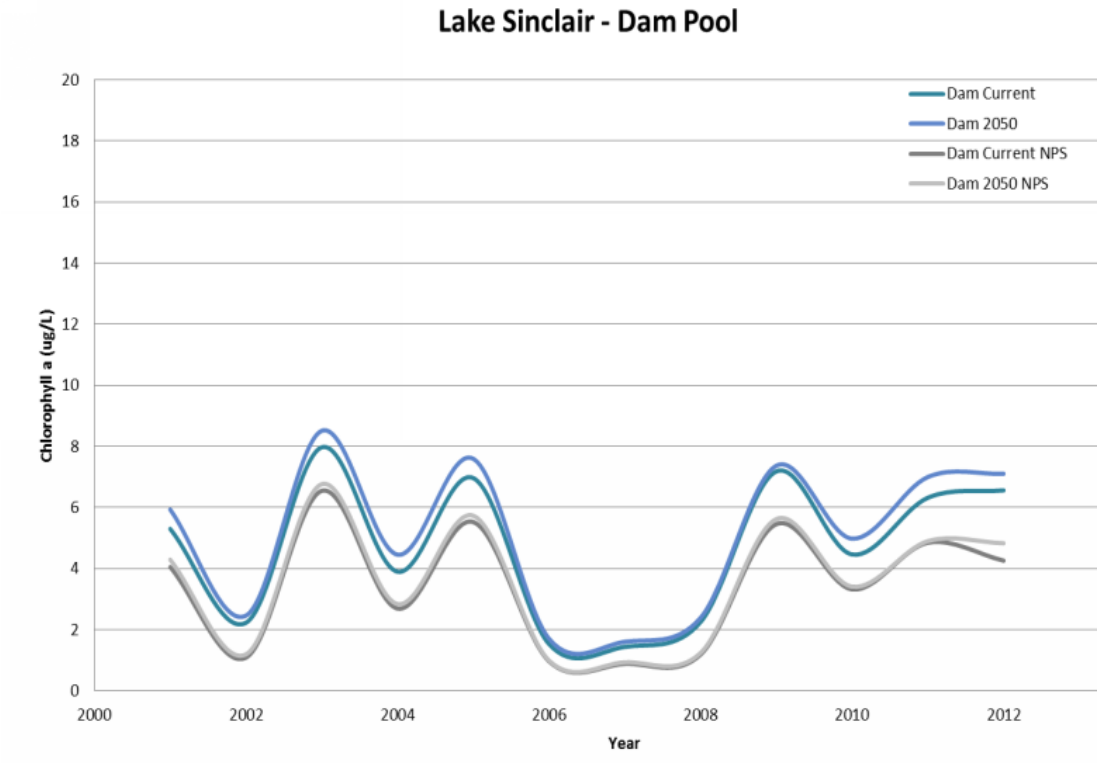


Figure 5-6: Growing Season Median Chlorophyll-a Concentration – Lake Sinclair





5.4 Future Treatment Capacity Comparison

Based on a comparison of the future wastewater capacity needs with existing permitted capacity, future demands for municipal wastewater management can largely be met with existing permitted facilities (Table 5-7). Availability of existing permitted wastewater capacity in the Region suggests that future management practices described in Sections 6 and 7 will need to focus on the specific counties where capacity shortages are likely to occur. This currently includes just Walton County. The permitted quantities are based on existing municipal facilities permitted under the National Pollutant Discharge Elimination System (NPDES) or State land application systems (LAS) permits. It should be noted that the comparison in Table 5-7 was completed at the county level and additional localized shortages in treatment capacity may exist.

Table 5-7: Permitted Municipal Wastewater Discharge Limits vs. 2050 Forecasted Municipal Wastewater Flows (MGD)[1]

County	Point Source (PS)			Land Application Systems (LAS)		
	2050 Forecast[1]	Permitted Capacity	2050 Surplus or Gap (-)	2050 Forecast[2]	Permitted Capacity	2050 Surplus or Gap (-)
Baldwin	3.85	10.5	6.65	0	0	0
Barrow	9.78	11.1	1.32	1.03	1.42	0.39
Athens- Clarke	18.74	24.0	5.31	0.01	0.01	0.00
Greene	0.32	1.45	1.13	0.38	0.65	0.27
Hancock	0.03	0.06	0.03	0.26	0.8	0.54
Jackson	6.19	8.7	2.51	0.37	1.02	0.65
Laurens	3.83	6.36	2.52	0.27	0.75	0.48
Morgan	0.85	1.85	1.00	0.01	0.1	0.09
Oconee	3.24	6.00	2.76	0.35	0.41	0.06
Putnam	0.53	1.27	0.74	0.18	0.5	0.32
Walton	11.26	9.8	**-1.46**	0.13	0.35	0.22
Washington	1.00	2.22	1.22	0.18	0.3	0.12
Wilkinson	0.27	0.79	0.52	0	0.3	0.30

[1] The forecasted municipal wastewater flows presented are annual average values (MGD), and the permitted capacity values are based upon the monthly average discharge limits (MGD) for wastewater facilities in the County.
[2] Includes industrial wastewater expected to be treated at municipal facilities.

5.5 Summary of Potential Water Resource Gaps, Needs, and Shortages

Table 5-8 summarizes the counties occurring upstream of planning nodes with potential water resource gaps or infrastructure needs or shortages from the previous subsections to help guide the appropriate selection and application of management practices in Sections 6 and 7. The basis, or source, for each potential gap or need/shortage is noted so the reader can return to the source of the gap or need/shortage for further explanation. In addition to indicating the results of the watershed-based nutrient modeling for those watersheds contributing to Lake Oconee and the Oconee River, the water quality 303(d) issues column also integrates the widespread listings of impaired streams in the Region that were noted in Section 3.3.2.

Table 5-8: Summary of Potential Gaps, Needs, or Shortages by County

County	Ground-water Gaps	Surface Water Gaps	Municipal Water Needs	Municipal Wastewater Shortages	Water Quality – Assimilative Capacity Gaps	Water Quality 303(d) Issues
For more details see:	*Section 5.1*	*Figure 5-2*	*Table 5-5*	*Table 5-7*	*Figure 5-3*	*Sections 3.3.2 and 5.3.2*
Baldwin						Yes
Barrow						Yes
Athens-Clarke						Yes
Greene		Yes				Yes
Hancock		Yes				Yes
Jackson						Yes
Laurens					Yes	Yes
Morgan					Yes	Yes
Oconee						Yes
Putnam					Yes	Yes
Walton				Yes		Yes
Washington		Yes				Yes
Wilkinson					Yes	Yes
Total Counties	**0**	**3**	**0**	**1**	**4**	**13**

Notes: "Yes" indicates that there is a potential gap or need/shortage in the indicated county or a water quality issue.
"Gap" is defined as a condition where the existing or future conditions exceed the Resource Assessment metric.

Section 6. Addressing Water Needs and Regional Goals

This Section presents the Council's management practices, selected to address the water resource management issues (such as potential gaps or shortages) identified and described in Section 5, and/or to meet the Council's vision and goals described in Section 1.3.

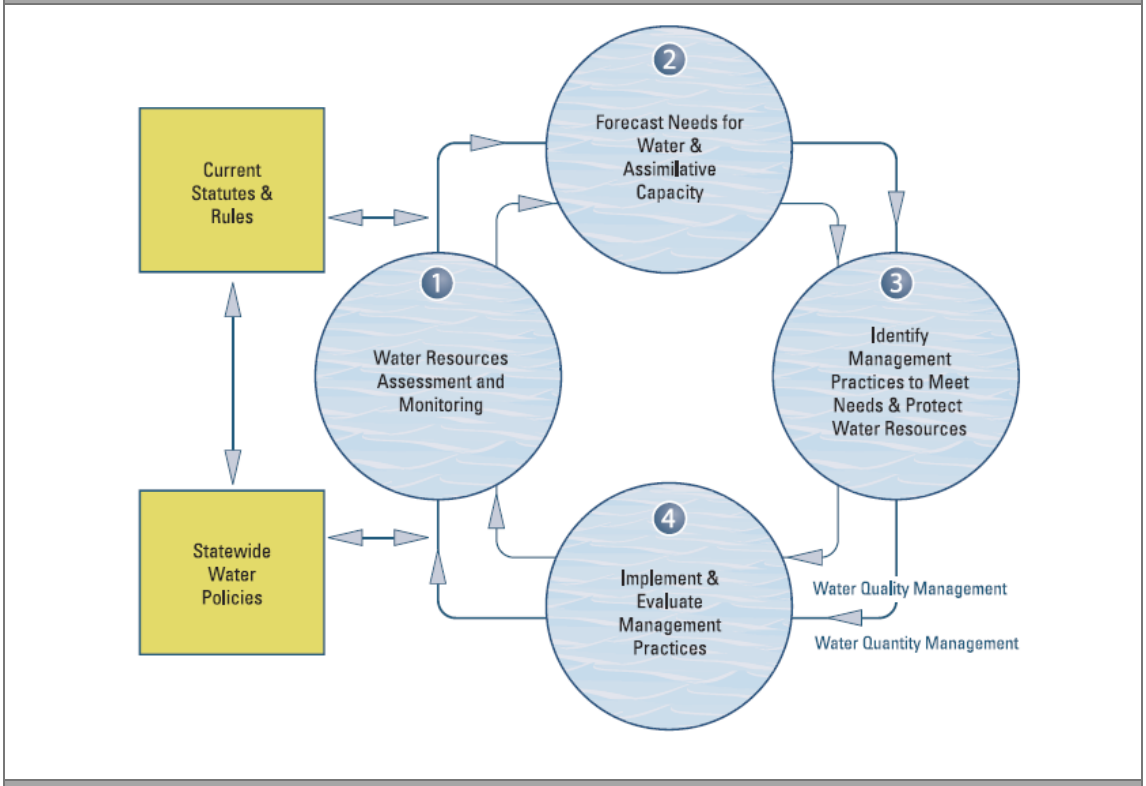
Section Summary

A prioritization and ranking process resulted in the Council selecting 10 Water Conservation, 7 Water Supply, 8 Wastewater, and 10 Water Quality Management Practices.

6.1 Identifying Water Management Practices

The State Water Plan defines management practices as reasonable methods, considering available technology and economic factors, for managing water demand, water supply, return of water to water sources, and prevention and control of pollution of the waters of the state. The plan builds upon Georgia's current statutory framework to create a more integrated water management policy, with management practice selection as part of an adaptive four-step water planning process. This process is consistent with current state laws and policies. Figure 6-1 illustrates how it interacts with State-wide water policy.

Figure 6-1: Relationship of Management Practices to Georgia Rules and Statutes



Source: Georgia Water Council, 2008

Identification of potential management practices appropriate for the Region started with a review of existing local and regional plans, which helped update the Council about practices already in place. Section 5 compares the Resource Assessments described in Section 3 with the forecasted future needs described in Section 4. Section 5 also summarizes the Region's existing or likely future water resource or infrastructure issues and demonstrates the need for County- and resource-specific management practices. In areas with no issues or gaps, the management practices have been selected to meet needs specified by the Council (i.e., facility/infrastructure needs and practices, programmatic practices, etc.) that are aligned with the Region's vision and goals.

6.1.1 Review of Existing Plans and Practices

The Council conducted a comprehensive review of existing local and regional Water Management Plans and relevant related documents to frame the selection of management practices. The types of plans/studies that were reviewed to support identification and selection of the management practices for the Upper Oconee Region consisted of the following:

- Best Management Practices (forestry, agriculture, and stormwater management)
- Comprehensive Work Plans (local and regional scale)
- EPD databases (permitted withdrawals, planned projects, and proposed reservoirs)
- Regional infrastructure and permitting plans
- State-wide guidance documents (conservation, cost, and water planning)
- TMDL evaluations
- Water quality studies, including watershed protection plans (basin, watershed, and local scale)

6.2 Selected Water Management Practices for the Upper Oconee Region

This Section presents the management practices selected by the Council to address the water resource issues and gaps identified in Section 5 and to meet the Council's vision and goals. Each subsection groups management practices by the primary water resource area addressed, such as Water Quality or Water Conservation, and then generally lists the practices in order of the total benefit ranking assigned by the Council. Management practices may not be applicable to all sub-geographies or local governments based on existing conditions or future gaps or needs/shortages in resources or infrastructure. The Council assumes that the list of management practices would be considered for implementation based on local needs. Section 7 provides a summary of the recommendations for implementation responsibilities.

During the management practice selection process, the Council formed a subcommittee to review and update their original 2011 Regional Water Plan management practices. The subcommittee reviewed the types of management practices already being implemented, local needs, and the feasibility of local implementation of management practices to address potential resource or infrastructure gaps or shortages. Tables 6-1(a) through 6-1(d) identify the management practices adopted by the Council for implementation.

6.2.1 Water Conservation Management Practices

Georgia will need to practice water conservation in order to meet its long-term water needs. Conservation also helps ensure responsible use of a public resource and may reduce the need for, or delay, implementation of potentially costly water supply management practices. As laid out in this Section, this Regional Water Plan's approach to water conservation will be accomplished by setting water conservation goals and requiring water withdrawal permittees to demonstrate progress toward those goals, while providing for due consideration of technical feasibility, cost-effectiveness, conservation measures in place prior to the adoption of this plan, and water use required by other regulatory programs for human health and sanitation.

Water conservation is a priority management practice in Section 7, Policy 3 of the State Water Plan and the State Water Conservation Implementation Plan (WCIP). The latter, released in March 2010, identifies water conservation goals, benchmarks, and best management practices for the State's diverse water users. The WCIP framed the following conservation tiers for each Council to use during management practice selection:

- Tier 1: Basic water conservation activities and practices that are currently required by statute or will soon be required in GAEPD's upcoming amended rules.
- Tier 2: Basic water conservation activities and practices that will be addressed in upcoming amended rules, but are not required of all permit applicants.
- Tier 3: Basic water conservation practices (for all water use sectors) that will not be addressed in current or upcoming amended rules.
- Tier 4: "Beyond basic" water conservation practices to be considered if a gap exists between current or future water supplies and demands for the Region.

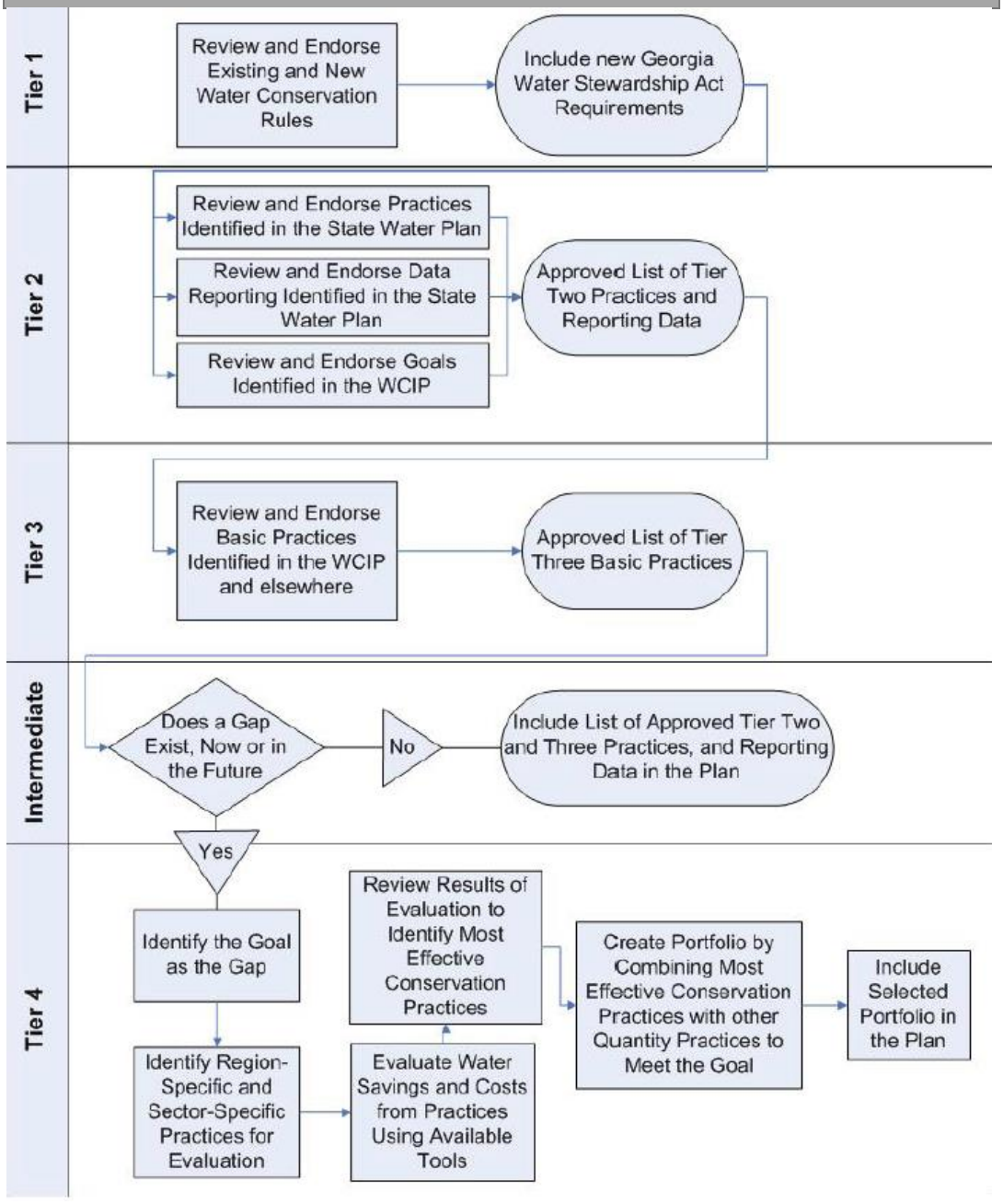
Figure 6-2 illustrates the process used to consider these tiered practices during selection of the Water Conservation Management Practices listed in Table 6-1(a) (GAEPD, 2010b). Three of the Council's goals specifically address conservation or water infrastructure optimization:

Goal # 1: Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Upper Oconee Region.

Goal # 3: Educate stakeholders in the Region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency.

Goal # 6: Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.

Figure 6-2: Water Conservation Guidance Process Flow Chart



Source: GAEPD, 2010b.

The 10 final Water Conservation management practices listed in Table 6-1(a) meet the goals noted above, address potential gaps at the Eden node in order to extend the life of the existing water supplies, and address potential gaps in Greene, Hancock, and Washington Counties; these potential gaps are discussed in Section 5 and summarized in Table 5-8. Additionally, the management practices promote increased efficiency by agricultural users to decrease water demand from the groundwater aquifers. Many of the management practices involving public education address multiple sectors, such as both water conservation and nonpoint source/water quality issues.

Table 6-1(a): Water Conservation Management Practices Selected for the Region

Action Needed (Management Practice)	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WC-1. Encourage conservation pricing	Encourage conservation pricing to provide economic incentive for people to use water more efficiently within the entire Region. Specific measures for implementation are to: (1) Perform a rate and revenue analysis, and (2) Review and update pricing on a regular basis.	**Vision:** Manage water as a critical resource. Supports WS, RS, ES, and CR goals.[1]
WC-2. Develop water conservation goals	Identify achievable, measurable goals to help local governments evaluate long-term water supply needs and to provide benchmarks for determining progress in reducing water supply gaps through conservation. Goals should be both regional and local regardless of where water supply gaps exist in the Resource Assessments.	**Vision:** Manage water as a critical resource. Supports WS, CR, ES, and BP goals.[1]
WC-3. Encourage education and public awareness programs	Encourage local jurisdictions to develop an education and public awareness program focused on water conservation and water quality improvement awareness needs.	**Vision:** Develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and CR goals.[1]
WC-4. Encourage variable rate agricultural irrigation systems	Promote variable rate irrigation systems, which allow for different irrigation rates depending on site-specific water needs.	**Vision:** Manage water as a critical resource Supports WS, WQ, BP and CR goals.[1]

Table 6-1(a): Water Conservation Management Practices Selected for the Region		
Action Needed (Management Practice)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WC-5. Encourage non-potable reuse	When and where feasible: (1) Identify areas with potential for reuse application to offset existing or future withdrawals; (2) Promote irrigation with high quality treated effluent in unrestricted areas, such as golf courses and parks. (3) Encourage industries to use reclaimed water for processes such as cooling when feasible.	**Vision:** Manage water as a critical resource. Supports WS and CR goals.[1]
WC-6. Encourage retrofitting of rain sensor shut-off switches on irrigation systems	Encourage retrofitting on residential and commercial systems (excluding golf courses and agriculture irrigation) to utilize irrigation systems that automatically shut off during rain events or moist soil conditions. Investigate the potential for legislation or local government ordinances to require installation in new facilities where shortages are anticipated. Develop educational materials for residents and businesses to encourage retrofitting of rain sensors, the use of cisterns for irrigation systems, as well as the proper use and operation of rain sensors.	**Vision:** Manage water as a critical resource. Supports WS, BP, and CR goals.[1]
WC-7. Encourage new car washes to recycle water	Encourage all new car wash establishments, regardless of size and scale, to recycle wash water to minimize the amount of potable water used during their processes and to capture and treat stormwater properly. Programs can either be mandated for new establishments or voluntary through local ordinances. For voluntary programs, incentives, such as a certification that can be displayed and/or advertised, can be offered.	**Vision:** Manage water as a critical resource. Supports WS, WQ, and CR goals.[1]
WC-8. Encourage residential water audits	Develop a regional residential water audit program. Distribute water audit guidelines. Encourage voluntary audits.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, ES, and CR goals.[1]

Table 6-1(a): Water Conservation Management Practices Selected for the Region		
Action Needed (Management Practice)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WC-9. Encourage certification of irrigation specialists	Trained irrigation specialists understand the design, installation and maintenance of irrigation application timing and levels of water needed by vegetation as well as the technologies and installations that will increase water use efficiency of irrigation systems in the Region.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ and CR goals.[1]
WC-10. Encourage commercial water audits	Identify an agency to conduct commercial audits and train personnel to conduct them throughout the Region. Advertise and promote the commercial water audit program. Conduct commercial audits with interested commercial partners. Report results to commercial partners and encourage use of the results in future decisions related to water use efficiency and conservation.	**Vision:** Develop an educated and engaged citizenry that embraces sound water management. Supports WS, BP and CR goals.[1]

[1]Goals were given the following acronyms during the MP ranking and selection process:

CR: Conservation and Reuse – Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Region

BP: Balance Priorities – Ensure that Management Practices balance economic development, recreation, and environmental interests

ES: Educate Stakeholders – Educate stakeholders in the Region on the importance of water quality and managing water as a resource, including practices such as water conservation and increased water efficiency

DA: Data Management – Encourage the development and provision of easily accessible data and information to guide management decisions

WQ: Water Quality – Identify programs, projects, and educational messages to reduce nonpoint source pollution to protect water quality in lakes and streams

RS: Revenue Strategies – Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency

WS: Water Supply – Identify and plan measures to ensure sustainable, adequate water supply to meet current and predicted long-term population, environmental, and economic needs

WW: Wastewater

WC: Water Conservation

6.2.2 Water Supply Management Practices

Management practices that supplement water supply play an important role in addressing the Region's potential water resource gaps that are summarized in Table 5-8. Of the 13 counties in the Region, none of the counties are associated with potential groundwater resource supply gaps, and 3 counties are upstream of planning nodes with potential surface water supply resource gaps, as described in Section 5. Table 6-1(b) outlines the 7 Water Supply Management Practices targeted for implementation in the Region to address these potential gaps, needs, and shortages by decreasing water demand, increasing surface and groundwater supplies and returning more water to streams; thus, making more water available for downstream users.

Two of the Council's goals specifically address water supplies or water infrastructure optimization:

Goal #6: Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.

Goal # 7: Identify and plan measures to ensure sustainable, adequate water supply to meet current and predicted long-term population, environmental, and economic needs.

Table 6-1(b): Water Supply Management Practices Selected for the Region

Action Needed (MP)	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WS-1. Expand existing reservoirs	Evaluate yield and potential expansion of existing facilities. Evaluate potential for Natural Resources Conservation Service (NRCS) impoundments to serve as water supply sources; estimate yield; identify any potential water quality and environmental issues.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, WQ, BP, and CR goals.[1]
WS-2. Construct new water supply reservoirs	Water Management Councils and GAEPD to identify the yield of current sources. Identify when potential shortages between available supply and demand will occur. Require a financial feasibility study as a part of new water supply reservoir assessment. Encourage local governments to coordinate with each other to develop regional water supply projects. Local governments should begin permitting processes early for new water supplies.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, BP, and CR goals.[1]
WS-3. Develop new groundwater wells	Evaluate potential for groundwater supplies (likely as supplemental source). Permit wells as needed and practicable.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, RS and BP goals.[1]
WS-4. Encourage development of water master plans with periodic update	Create and utilize a local water master plan with a 30-year planning horizon. Update local water master plans. Develop or update local emergency water plans. Update a minimum of every 5 years.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, RS, and ES goals.[1]

Table 6-1(b): Water Supply Management Practices Selected for the Region		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WS-5. Encourage indirect potable reuse	Return highly treated wastewater to water supply reservoirs and streams.	**Vision:** Manage water as a critical resource. Supports WS, BP and CR goals.[1]
WS-6. Expand existing withdrawals from available reservoirs	Negotiate with Georgia Power on potential expansion of existing withdrawals.	**Vision:** Manage water as a critical resource and build trusting partnerships between neighboring regions. Supports WS, RS, and BP goals.[1]
WS-7. Encourage water system asset management	Map water system assets. Develop a water system asset management program. Develop targeted asset replacement/rehabilitation program to prevent catastrophic failures. Coordinate asset management and leak detection programs.	**Vision:** Manage water as a critical resource. Supports WS, BP, ES, and CR goals.[1]
[1]See endnotes of Table 6-1(a) for goal acronyms.		

6.2.3 Wastewater Management Practices

The *Surface Water Quality Resource Assessments* described in Section 5.3 were performed to measure the assimilative capacity, or the ability of surface waters to absorb pollutants from treated wastewater and stormwater without unacceptable degradation of water quality. The Resource Assessments also highlighted the need for nutrient load reductions to Lakes Oconee and Sinclair to address future water quality issues. Table 5-8 summarizes the results of these Resource Assessments and potential wastewater infrastructure shortages. One of the 13 counties in the Region has a wastewater infrastructure shortage that added emphasis on implementation of the eight Wastewater Management Practices listed in Table 6-1(c).

Two of the Council's goals specifically address wastewater infrastructure:

Goal # 1: Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Upper Oconee Region.

Goal # 6: Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.

Table 6-1(c): Wastewater Management Practices Selected for the Region		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WW-1. Encourage implementation of centralized sewer in developing areas where density warrants	Identify areas that would benefit from being served by a centralized sewer versus septic systems. Work with developers to ensure they understand the program.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, RS, WQ and, BP goals.[1]
WW-2. Encourage development of local wastewater master plans / Evaluate wastewater treatment and disposal options to meet future demands	Evaluate future wastewater capacity needs. Identify and evaluate options to treat and dispose of wastewater, including reuse. Focus on existing public utilities. Update a minimum of every 5 years.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, RS, WQ, and BP goals.[1]
WW-3. Develop recommendations for decentralized sewer systems	Evaluate potential for designing decentralized systems so they can potentially connect to a centralized sewer system in the future when available. Identify implementation issues. Develop design standards for smaller, clustered systems. Implement design standards. Work with developers to ensure they understand the program. Establish policies for future connections to centralized sewer. Coordinate with local governments on the development of private wastewater system ordinance(s).	**Vision:** Manage water as a critical resource. Supports WQ, WS, and BP goals.[1]
WW-4. Develop septic system planning and management policies and guidance	Determine future septic system areas and local requirements. Develop near- and long-term policies for transitioning unsewered areas to sewered areas where financially feasible. Identify grant funds or other sources to develop and implement education program. Identify and manage septic systems in environmentally sensitive areas. Implement a septic system homeowner education program. Create a septic system map. Require septic tank certification program as part of the homebuyer closing process.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, WS, and BP goals.[1]

Table 6-1(c): Wastewater Management Practices Selected for the Region		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WW-5. Develop and implement sewer system capacity, management, operation, and maintenance (CMOM) program	Create a sewer system map. Implement sewer inspection and maintenance programs. Conduct inspection and maintenance training. Implement sewer system rehabilitation programs. Develop sewer system overflow emergency programs. Develop sewer system asset management programs.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and BP goals.[1]
WW-6. Provide local government with acceptable parameters for septage disposal at facilities	Develop a plan and acceptable parameters for septage disposal. Collect septage manifests and provide to County Boards of Health. Consider septage disposal needs when upgrading or designing new wastewater treatment facilities.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that supports sound water management. Supports WQ, WS, and ES goals.[1]
WW-7. Implement grease management program	Develop procedures for grease control and enforcement. Implement fats, oils, and grease (FOG) education efforts.	**Vision:** Manage water as a critical resource and develop an engaged citizenry that embraces sound water management. Supports WQ and ES goals.[1]
WW-8. Implement "Do Not Flush" management program	Implement educational materials and informational campaign illustrating materials that should not and cannot be flushed if SSOs are to be prevented. Develop guidance / requirements for capture and removal of foreign materials that may be flushable, but non-biodegradable, before they reach the sewer system.	**Vision:** Manage water as a critical resource and develop an engaged citizenry that embraces sound water management. Supports WQ and ES goals.[1]
[1] See endnotes of Table 6-1(a) for goal acronyms.		

6.2.4 Water Quality Management Practices

Significant progress has been made in Georgia in managing pollution from point sources; however, the State's future growth will continue to bring land cover conversion, more intensive land uses, and increases in the volume of pollutants discharged to waters from both point and non-point sources. Table 5-8 notes the 4 counties with assimilative capacity water quality gaps and illustrates that the entire Region needs to focus on the implementation of Water Quality Management Practices to address the 303(d) listings of impaired waters in each County and achieve nutrient load reductions in watersheds

contributing to Lakes Sinclair and Oconee. Implementation of the 10 Water Quality Management Practices described in Table 6-1(d) would build on the existing TMDL and stormwater management activities already being performed by the MS4 or NPDES permittees within the Region. Some management practices—such as WQ-10, which calls for monitoring of long-term ambient trends—will facilitate the tracking of long-term point and nonpoint source pollutant loads. This will be useful in addressing water quality issues throughout the Region and will help inform future Regional Water Plan updates.

Two of the Council's goals specifically address water quality:

Goal #3: Educate stakeholders in the region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency.

Goal #5: Identify programs, projects, and educational messages to reduce non-point source pollution to protect water quality in lakes and streams.

Table 6-1(d): Water Quality Management Practices Selected for the Region

Action Needed (MP)	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WQ-1. Encourage comprehensive land use planning	Use land use planning to encourage development in certain areas and discourage development in environmentally sensitive areas. Protect open space along riparian corridors, wetlands, and groundwater recharges areas to help protect water resources. Monitor compliance with Part V (environmental criteria).	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, BP, and CR goals.[1]
WQ-2. Encourage local government participation in construction erosion and sediment control	Develop a training program for citizens and contractors who implement erosion and sediment control programs. Consider implementation of the *Better Back Roads Manual* recommendations for dirt road maintenance, drainage improvements, stabilization and erosion control (GA RC&D, 2009).	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals.[1]

Table 6-1(d): Water Quality Management Practices Selected for the Region		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WQ-3. Encourage implementation of agricultural nutrient management programs	Utilize existing standards and practices to develop plans for the application of nutrients (including animal waste), typically row crops and hay, at rates that are used by plants to avoid excessive nutrient runoff. Utilize educational materials from the Georgia Department of Agriculture, University of Georgia College of Agriculture and Environmental Sciences, and the Georgia Farm Bureau to encourage agricultural nutrient management.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WQ goal.[1]
WQ-4. Encourage forestry management practices	Continue to implement the measures and practices outlined in the Georgia Forestry Commission BMP manual.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals.[1]
WQ-5. Encourage stream buffer protection	Continue to implement the measures and practices outlined through current legislation and local jurisdictions.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals.[1]
WQ-6. Encourage floodplain management / flood damage prevention	Implement site plan review practices to minimize development in the floodplain.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals.[1]

Table 6-1(d): Water Quality Management Practices Selected for the Region		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WQ-7. Encourage general stormwater practices	Implement practices such as: • Measures to minimize stormwater runoff through site planning (conservation subdivisions and other practices) and land use planning. • Stormwater system inventory and maintenance. • Preventing pollutants from reaching stormwater systems through good housekeeping or illicit discharge detection programs. • Public education. • Capital programs to develop Management Practices, regional ponds, and other watershed practices. Implement post-development stormwater controls to decrease runoff velocity and promote infiltration, such as stormwater retention ponds, constructed wetlands, grassed swales, and other low-impact development methods, for new development and redevelopment areas to address hydrology and water quality.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and ES goals.[1]
WQ-8. Support total maximum daily load (TMDL) implementation	Evaluate existing impaired waters, investigate potential pollutant sources, and participate in the TMDL development and implementation planning processes. Comply with TMDLs.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and ES goals.[1]
WQ-9. Encourage agricultural cropland management practices	Encourage the use of agricultural crop practices as outlined in the Soil and Water Conservation Commission BMP for Georgia Agricultural Manual. Examples of such include the following: conservation tillage, cover crops, field buffers, riparian forested buffers, land conversion (crop to forest), and strip cropping.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and BP goals.[1]

Table 6-1(d): Water Quality Management Practices Selected for the Region		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WQ-10. Monitor long-term ambient trends	Include long-term water quality, habitat, and biological monitoring. Use long-term monitoring to help stakeholders evaluate the extent which watershed practices are working. Implement consistent, equitable monitoring across the Region.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, BP, WQ, DA, and ES goals.[1]

[1] See endnotes of Table 6-1(a) for goal acronyms.

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Section 7. Implementing Water Management Practices

This Section presents the Council's roadmap for implementing the water management practices identified in Section 6. As the State Water Plan indicates, this Regional Water Plan will be primarily implemented by the various water users in the Region along with the other responsible parties described below.

Once adopted, this Regional Water Plan will be used to guide permitting decisions by GAEPD and guide the awarding of State grants and loans from the Georgia Environmental Finance Authority (GEFA) for water-related projects. And this plan can help inform and guide other GAEPD programs such as the awarding of Section 319(h) Nonpoint Source Implementation Grant funds.

Section Summary

The Council has developed a roadmap for implementing the Management Practices identified in Section 6. The roadmap specifies the short-term (next five years) and long-term (beyond the next five years) actions needed to implement the Management Practices for the corresponding responsible parties.

Responsibility for most of the implementation actions falls to local governments and utilities and their respective Regional Commissions; however, extensive support will be needed from various State entities for initial activities, in particular.

7.1 Implementation Schedule and Roles of Responsible Parties

Tables 7-1(a) through 7-1(d) identify the short- and long-term actions needed to implement the Management Practices detailed in Tables 6-1(a) through 6-1(d) and the corresponding responsible parties for each series of actions. Actions for implementation are framed as initial activities expected to occur as short- or long-term actions. The Council has defined short-term as occurring within the next five years and long-term as beyond the next five years. It is assumed that all long-term activities would occur after the 5-year Regional Water Plan update, allowing for the Council to revisit these actions using an adaptive management approach.

While the bulk of implementation actions noted in Tables 7-1(a) through 7-1(d) fall to local governments and utilities and their respective RCs, extensive support for short term activities, in particular, will be needed from State entities, such as GAEPD, DCA, Georgia Department of Community Health (DCH), Division of Public Health, Environmental Health Section, and GEFA. This Regional Water Plan also assumes continued support from the Council in some capacity beyond its current 3-year appointment. Support from other organizations, such as the Association of County Commissioners of Georgia (ACCG), Georgia Green Industry Association (GGIA), Georgia Municipal Association (GMA), Georgia Rural Water Association (GRWA), and Georgia Association of Water Professionals (GAWP), will also be needed to implement the management practices in an efficient, cost-effective manner.

7.1.1 Implementation of Water Conservation Management Practices

Table 7-1(a) lists implementation details for the 10 Water Conservation Management Practices selected by the Council and detailed in Table 6-1(a). The list includes a wide variety of practices, such as practices that benefit all communities (e.g., WC-3, Implement education and public awareness program) and practices that may be appropriate for some communities, but not for others (e.g., WC-5, Encourage non-potable reuse). Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with Resource Assessment gaps or infrastructure needs/shortages are strongly encouraged to implement these Water Conservation practices to address these water resource issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

Table 7-1(a): Water Conservation Management Practice Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[b]
WC-1. Encourage conservation pricing	MU	Implement Conservation Pricing, if needed.	Revise Rate Study and Rates, if needed.	Local governments and utilities.
WC-2. Develop water conservation goals	MU	• Identify achievable, measurable goals (and benchmarks) to help local governments evaluate progress and success in reducing water supply gaps through conservation. • Develop ways to track progress in meeting conservation goals and reporting of progress.	• Administer Survey to gauge progress toward meeting water conservation goals during the short term. • Revise program during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	GAEPD and Regional Councils working with the RCs noted in Section 2.3 with support from organizations such as the ACCG, GMA, GRWA, and GAWP.
WC-3. Encourage education and public awareness programs	MU and MS4	Implement the Education and Public Awareness program.	• Administer Survey to gauge effectiveness of program during the short term. • Revise Education and Public Awareness program during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Short-term Actions: Local governments noted in Section 2.1.1. Long-term Actions: GAEPD and Regional Councils working with the RC.
WC-4. Encourage variable rate agricultural irrigation systems	AG	• Identify incentives to encourage the installation and use of variable rate irrigation systems. • Implement with the support of the GSWCC. • Integrate message regarding cost-effectiveness of variable rate irrigation into the Public Education and Awareness Program (see WC-3).	• Evaluate requiring variable rate irrigation systems in water-limited areas. • Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Short-term Actions: GAEPD and GSWCC Long-term Actions: GAEPD, Regional Councils and GSWCC

Table 7-1(a): Water Conservation Management Practice Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[b]
WC-5. Encourage non-potable reuse	MU and MUWW	Develop implementation costs and assess feasibility of serving non-potable reuse water.	Encourage industries to use reclaimed water for processes, such as cooling, when technically and economically feasible.	GEFA, Industry, local governments, and utilities.
WC-6. Encourage retrofitting of rain sensor shut-off switches on irrigation systems	MU	• Develop regional guidelines / educational materials for local implementation. • Require installation or retrofitting to utilize irrigation systems that automatically shut off during rain events or moist soil conditions. • Integrate message regarding cost-effectiveness of variable rate irrigation into the Public Education and Awareness Program (see WC-3).	• Require switches in water-limited areas and revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness. • Develop maintenance program to ensure long-term effectiveness of sensors.	. Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.
WC-7. Encourage new car washes to recycle water	MU and MS4	• Develop regional guidelines / program materials or templates requiring all new car wash establishments to recycle wash water. Integrate with GAEPD's existing Carwash BMP program • Implement with the support of the local government business licensing process. • Integrate message into the Public Education and Awareness Program (see WC-3).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.
WC-8. Encourage residential water audits	MU	Implement regional program via Public Education and Awareness (see WC-3) to encourage voluntary audits and educate the public about water audit guidelines.	• Administer Survey to gauge progress toward meeting water conservation goals during the short term. • Revise program during 5-year Regional Water Plan update, if necessary, to improve effectiveness. • Identify/create incentive program	. Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.

Table 7-1(a): Water Conservation Management Practice Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[b]
WC-9. Encourage certification of irrigation specialists	AG and MU	• Consider creating a certification requirement and process for irrigation specialists. • Develop regional educational materials regarding the value of using a trained, certified residential/commercial irrigation specialist to increase water use efficiency within the agricultural and green industry. • Encourage certification of irrigation specialists via Public Education and Awareness Program (see WC-3).	Evaluate whether requirement for certified irrigation specialists should be considered in plan update.	Short-term Actions: GAEPD Agriculture Water Permitting Unit and Regional Councils working with the GSWCC Agriculture Meter Program, GGIA, and GSWCC.
WC-10. Encourage commercial water audits	MU	• Implement regional program via Public Education and Awareness Program (see WC-3). • Advertise and promote the water audit program. • Conduct audits with interested commercial partners.	• Administer Survey to gauge Results during the short term. • Report results to commercial partners and revise program during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs and GADNR Sustainability Division.

[a] Permittee Categories of Responsible Parties have the following acronyms and refer to the entities who may have permits of various types through GAEPD:
AG: Agricultural Water Withdrawal
CST: Construction Stormwater
GC: Golf Course Water Withdrawal
IND: Industrial Water Withdrawal
INDST: Industrial Stormwater
INDWW: Industrial Wastewater
MU: Municipal Water Withdrawal
MS4: Municipal Stormwater
MUWW: Municipal Wastewater
SD: Safe Dams Program

[b] Assumes continued support from the Council in some capacity beyond their 3-year appointment.

7.1.2 Implementation of Water Supply Management Practices

Table 7-1(b) lists implementation details for the 7 Water Supply Management Practices selected by the Council and as indicated in Table 6-1(b). The list includes a wide variety of practices, such as practices that benefit all communities (e.g., WS-4, Encourage development of water master plans with periodic updates), and practices that may be appropriate for some communities, but not for others (e.g., WS-2 Construct new water supply reservoirs). Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with Resource Assessment gaps or infrastructure needs/shortages are strongly encouraged to implement these Management Practices to address their water resource issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

Table 7-1(b): Water Supply Management Practice Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Short-term Actions (Next 5 Years)	Long-term Actions: (5 Years and Beyond)	Responsible Parties[b]
WS-1. Expand existing reservoirs	MU and SD	• Evaluate potential expansion of existing reservoirs. • Identify and evaluate potential for retrofitting NRCS impoundments for water supply use. • Begin process of expanding existing reservoirs.	Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary. Continue to maximize existing reservoir capacities.	Local governments and utilities with support from GAEPD and NRCS.
WS-2. Construct new water supply reservoirs	MU	• Identify site-specific needs for new water supply reservoirs over the next 30 years via the local Water Master Planning Process and Regional Water Plan. • Identify opportunities to create regional reservoirs for cost sharing and efficiency. • Begin permitting process for new water supplies.	• Continue permitting process for new water supplies and construct as needed and as funding allows. • Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD.
WS-3. Develop new groundwater wells	IND and MU	• Identify site-specific needs for new groundwater wells over the next 30 years via the local Water Master Planning Process. • Begin permitting process for new wells and construct as needed and as funding allows.	• Continue permitting process for new wells and construct as needed and as funding allows. • Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary.	Industry, local governments, and utilities with support from GAEPD.

Table 7-1(b): Water Supply Management Practice Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Short-term Actions (Next 5 Years)	Long-term Actions: (5 Years and Beyond)	Responsible Parties [b]
WS-4. Encourage development of water master plans with periodic updates	MU	Consider developing (or revising) a local Water Master Plan to: • Include a 30-year planning horizon. • Include an emergency water plan. Reflect implementation of Regional Water Plan water Management Practices. Implement local water master plan. (See WW-2)	Revise local Water Master Plan periodically based on 5-year Regional Water Plan update.	Local governments and utilities with support from GAEPD.
WS-5 Encourage indirect potable reuse	MU and MUWW	• Identify opportunities to augment water supplies with highly treated wastewater via the local Water Master Planning Process. • Identify incentives to encourage potable reuse. • Implement via local water master plan. (See WS-4)	Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD and GEFA.
WS-6. Expand existing withdrawals from available reservoirs	MU	• Coordinate with current reservoir owners / operators to establish a clear process for local governments and utilities to follow when future water supply needs arise. • Identify need for expansion of future water withdrawals from existing reservoirs via local Water Master Planning process.	• Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary, to include this water MP. • Coordinate with current reservoir owners / operators and FERC, as needed, to meet future water supply needs.	Short-term Actions GAEPD, Regional Councils, local governments and utilities working with Georgia Power and FERC Local governments and utilities. Long-term Actions Local governments and utilities, GAEPD, and Regional Councils working with Georgia Power and FERC.
WS-7. Encourage water system asset management	MU	• Develop a water system asset management program, if one does not already exist • Develop targeted asset replacement/rehabilitation program to prevent catastrophic failures. • Begin or continue mapping of water system assets. • Coordinate asset management and leak detection programs.	• Continue asset management and leak detection programs. • Revise program based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD.

[a] See Table 7-1(a) for acronyms of Permittee Categories of Responsible Parties.
[b] Assumes continued support from the Council in some capacity beyond their 3-year appointment.

7.1.3 Implementation of Wastewater Management Practices

Table 7-1(c) lists implementation details for the 8 Wastewater Management Practices selected by the Council and as described in Table 6-1(c). The list includes a wide variety of practices, such as practices that benefit all communities (e.g., WW-2, Encourage development of local wastewater master plans/Evaluate wastewater treatment and disposal options to meet future demands) and practices that may be appropriate for some communities, but not for others (e.g., WW-3, Develop recommendations for decentralized sewer systems). Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with Resource Assessment gaps or infrastructure needs/shortages are strongly encouraged to implement these Management Practices to address their water resource issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

Table 7-1(c): Wastewater Management Practice Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[b]
WW-1. Encourage implementation of centralized sewer in developing areas where density warrants	MUWW	Implement local Wastewater Master Plan (See WW-2), working with developers to secure their participation.	Revise local Wastewater Master Plan based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD.
WW-2. Encourage development of local wastewater master plans / Evaluate wastewater treatment and disposal options to meet future demands	MUWW	Develop and implement local Wastewater Master Plan.	Revise local Wastewater Master Plan based on 5-year Regional Water Plan update.	Local governments and utilities with support from GAEPD.
WW-3. Develop recommenda-tions for decentralized sewer systems	MUWW	• Local governments to consider adoption of model ordinance for decentralized and clustered sewer systems. • Local Public Health Departments to implement revised minimum design standards.	Revise guidelines during 5-year Regional Water Plan update, if necessary.	Short-term Actions: Local governments and local Public Health Departments. Long-term Actions: GAEPD and Regional Councils working with State and local Public Health Department representatives.

Table 7-1(c): Wastewater Management Practice Implementation Schedule				
Management Practice	**Permittee Category of Responsible Parties[a]**	**Short-term Actions (Next 5 Years)**	**Long-term Actions (5 Years and Beyond)**	**Responsible Parties[b]**
WW-4. Develop septic system planning and management policies and guidance	MUWW	As part of local planning efforts: • Develop near- and long-term policies for transitioning to sewer in areas where feasible. • Identify grant funds or other sources to develop and implement Septic System Homeowner Education program. • Develop template materials for Septic System Homeowner Education efforts. Develop septic tank certification program as part of the homebuyer closing process. • Integrate Septic System Homeowner Education and septic certification program components into the Public Education and Awareness Program (see WC-3).	Track implementation and revise Regional Water Plan, if necessary.	Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with State and local Public Health Department representatives
WW-5. Develop and implement sewer system capacity, management, operation, and maintenance (CMOM) program	MUWW	• Develop regional CMOM guidelines or templates for local government and utility implementation. • Implement local CMOM programs. • Integrate CMOM topics into the Public Education and Awareness Program (see WC-3).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils with support from GAWP.
WW-6. Provide local government with acceptable parameters for septage disposal at facilities	MUWW	• Propose legislative changes, if needed, to allow for consistent, minimum parameters for local governments to utilize in determining whether septage is acceptable for disposal at their facilities. • Local governments and utilities to implement minimum septage disposal standards and regularly convey manifests to local Public Health officials.	Revise guidelines during 5-year Regional Water Plan update, if necessary.	Short-term Actions: Georgia State legislature, local governments and utilities working with local Public Health Department representatives. Long-term Actions: GAEPD and Regional Councils working with Georgia Division of Public Health and local Public Health Department representatives.

Table 7-1(c): Wastewater Management Practice Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[b]
WW-7. Implement grease management program	MUWW	• Develop regional Grease Management Program guidelines or templates for local government and utility implementation. • Implement local Grease Management Program. • Integrate FOG reduction message into the Public Education and Awareness Program (see WC-3).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	. Short-term Actions: GAEPD and Regional Councils working with the RCs; Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.
WW-8. Implement "Do Not Flush" management program	MUWW	• Develop "Do Not Flush" Management Program guidelines or templates for local government and utility implementation. • Implement local "Do Not Flush" Management Program. • Integrate "Do Not Flush" message into the Public Education and Awareness Program (see WC-3).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Short-term Actions: Local governments and utilities working with the RCs. Long-term Actions: Local governments and utilities working with the RCs.

[a] See Table 7-1(a) for acronyms of Permittee Categories of Responsible Parties.
[b] Assumes continued support from the Council in some capacity beyond their 3-year appointment.

7.1.4 Implementation of Water Quality Management Practices

Table 7-1(d) lists implementation details for the 10 Water Quality Management Practices selected by the Council and as described in Table 6-1(d). The list includes a wide variety of practices, such as practices required by state law (e.g., WQ-2. Encourage local government participation in construction erosion and sediment control), practices that benefit all communities (e.g., WQ-4, Encourage forestry management practices), and practices that may be appropriate for some communities. Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with Resource Assessment gaps or infrastructure needs/shortages are strongly encouraged to implement these Management Practices to address their water resource issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

Table 7-1(d): Water Quality Management Practice Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[b]
WQ-1. Encourage comprehensive land use planning		Integrate any needed revisions into local comprehensive plans during the next, regular 10-year update or 5-year updates to the Short-Term Work Program portion of the Community Agenda from the comprehensive plan.	• Implement comprehensive plan. • Coordinate with DCA regarding potential revisions to Chapter 110-12-1, Standards and Procedures for Local Comprehensive Planning, and the Part V Environmental Planning Criteria to facilitate implementation of the State Water Plan water Management Practices.	Short-term Actions: Regional Councils, local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with DCA and the RCs as well as local governments and utilities.
WQ-2. Encourage local government participation in construction erosion and sediment control	CST	Integrate construction erosion and sedimentation component into the Public Education and Awareness Program (see WC-34). Consider implementation of Better Back Roads program.	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether recommendations for changes to the existing Construction NPDES Program are needed.	Short-term Actions: Regional Councils, local governments and GSWCC supervisors Long-term Actions: GAEPD and Regional Councils
WQ-3. Encourage Implementation of agricultural nutrient management programs	AG	• Identify incentives to encourage local implementation of Nutrient Management guidelines. • Implement with the support of the GSWCC. • Integrate message into the Public Education and Awareness Program (see WC-3).	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether changes to guidelines are needed.	Short-term Actions: Agricultural Water Users, GSWCC, Regional Council, and NRCS. Long-term Actions: GAEPD, Regional Councils, GSWCC, and NRCS.

Table 7-1(d): Water Quality Management Practice Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[b]
WQ-4. Encourage forestry management practices		Expand education and enforcement of the measures and practices outlined in the Georgia Forestry Commission BMP manual.	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether recommendations for changes to the Georgia Forestry Commission BMP manual are needed.	Short-term Actions: Private foresters and the Georgia Forestry Commission Long-term Actions: the Georgia Forestry Commission
WQ-5. Encourage stream buffer protection		• Consider adoption of model stream buffer protection ordinance. • Revise development review process, if needed. • Integrate message into the Public Education and Awareness Program (see WC-4).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Short-term Actions: Regional Councils, local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the Regional Commissions.
WQ-6. Encourage floodplain management/ flood damage prevention		• Develop regional recommendations and a model flood damage prevention ordinance. • Develop educational materials emphasizing the importance of preventing flood damage. • Identify incentives and potential funding sources to encourage local implementation.	• Integrate message into the Public Education and Awareness Program (see WC-3). • Consider adoption of flood damage prevention ordinance. • Revise development review process, if needed. • Begin mapping location of future floodplains. • Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Short-term Actions: Regional Councils, GAEPD and GEMA. Long-term Actions: GAEPD and Regional Councils working with local governments and utilities.
WQ-8. Encourage general stormwater practices	MS4	• Consider implementation of regional guidelines for general stormwater management in non-MS4 communities. • Implement regional guidelines for general stormwater management in MS4 communities. • Integrate general stormwater management message into the Public Education and Awareness Program (see WC-4).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Short-term Actions: Regional Councils, MS4 and Non-MS4 local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.

Table 7-1(d): Water Quality Management Practice Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Short-term Actions (Next 5 Years)	Long-term Actions (5 Years and Beyond)	Responsible Parties[b]
WQ-9. Support total maximum daily load (TMDL) implementation	MUWW and MUST	Continue to follow TMDL implementation plans and to participate in GAEPD updates.	Update TMDL implementation plans, as needed, based on water quality and biological monitoring data as well as Resource Assessment results.	Short-term Actions: GAEPD, industry, local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.
WQ-9. Encourage agricultural cropland management practices	AG	• Implement with the support of the GSWCC. Integrate message into the Public Education and Awareness Program (see WC-3).	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether changes to guidelines are needed.	Short-term Actions: Agricultural Water Users, GSWCC, Regional Councils, and NRCS. Long-term Actions: GAEPD, Regional Councils, GSWCC, and NRCS
WQ-10. Monitor long-term ambient trends	MUWW, INDWW, MS4, and INDST	• Implement regional long-term ambient trend monitoring network for the Region. • Utilize GAEPD's online data management system to maximize use of and access to these data.	Utilize results of regional long-term ambient trend monitoring network to help guide the 5-year Regional Water Plan update and revise monitoring program, if needed.	Short-term Actions: GAEPD with support from industry, local governments and utilities. Long-term Actions: GAEPD

[a] See Table 7-1(a) for acronyms of Permittee Categories of Responsible Parties.
[b] Assumes continued support from the Council in some capacity beyond their 3-year appointment.

7.2 Fiscal Implications of Selected Water Management Practices

This Section outlines the general planning level costs for implementation of the management practices selected by the Council and potential funding sources and options. The guidance documents and sources used to inform the planning level cost information in Table 7-2 have not been updated. Accordingly, the values shown below should only be used as a general guide. Specific costs should be further evaluated and updated before being relied upon. Estimated unit costs are provided in Table 7-2.

Table 7-2: Cost Estimates for the Implementation Responsibilities

Management Practice	Capital/ Programmatic Cost	Funding Sources and Options	Notes and Sources for Costs[1]
WC-1. Encourage conservation pricing	$0-500 /MG	Utilities	GAEPD Cost Guidance WD-5
WC-2. Develop water conservation goals	$0-0.50 /capita	State, Local, Utilities	GAEPD Cost Guidance – various Ordinance and Policy Management Practices
WC-3. Implement education and public awareness program	$0.10-2.25 /capita	State, Local, Utilities	GAEPD Cost Guidance E-2
WC-4. Encourage variable rate agricultural irrigation systems	$2,000-4,000 /MG	State	GAEPD Cost Guidance WD-3
WC-5. Encourage non-potable reuse	$0-0.50 /capita	State, Local, Utilities	GAEPD Cost Guidance OP-9
WC-6. Encourage retrofitting of rain sensor shut-off switches on irrigation systems	$25-1000 /MG	Local, Utilities	GAEPD Cost Guidance WD-6
WC-7. Encourage new car washes to recycle water	$0-0.50 /capita	State, Local	GAEPD Cost Guidance – various Ordinance and Policy Management Practices
WC-8. Encourage residential water audits	$0.10-2.25 /capita	State, Local, Utilities	GAEPD Cost Guidance E-2
WC-9. Encourage certification of irrigation specialists	$0-0.50 /capita	State	GAEPD Cost Guidance – various Ordinance and Policy Management Practices
WC-10. Encourage commercial water audits	$25-1,000 /MG	State, Local, Utilities	GAEPD Cost Guidance WD-2
WS-1. Expand existing reservoirs	$10,000-150,000 /MG	State, Local, Utilities	GAEPD Cost Guidance WS-2
WS-2. Construct new water supply reservoirs	$10,000-350,000 /MG	State, Local, Utilities	GAEPD Cost Guidance WS-1
WS-3. Develop new groundwater wells	$1,000-100,000 /MG	State, Local, Utilities	GAEPD Cost Guidance WS-3

Table 7-2: Cost Estimates for the Implementation Responsibilities			
WS-4. Encourage development of water master plans with periodic updates	$1,000-2,000 /MG	Utilities	GAEPD Cost Guidance – various Ordinance and Policy Management Practices
WS-5. Encourage indirect potable reuse	$0-0.50 /capita	State, Local, Utilities	GAEPD Cost Guidance OP-9
WS-6. Expand existing withdrawals from available reservoirs	$1.5-4 million/MGD	Utilities	GAEPD Cost Guidance WT-2 – assume would need to expand intake and add treatment capacity; used low end
WS-7. Encourage water system asset management	$1,000-3,000 /MG	Utilities	GAEPD Cost Guidance WD-4
WW-1. Encourage implementation of centralized sewer in developing areas where density warrants	$0-$1 million /MGD	State, Local, Utilities	GAEPD Cost Guidance WW-8
WW-2. Encourage development of local wastewater master plans / Evaluate wastewater treatment and disposal options to meet future demands	$1,000-2,000 /MG	Utilities	GAEPD Cost Guidance – various Ordinance and Policy Management Practices
WW-3. Develop recommendations for decentralized sewer systems	$0-0.50 /capita	Local, Utilities	GAEPD Cost Guidance OP-9
WW-4. Develop septic system planning and management policies and guidance	$0-0.50 /capita	State, Local, Utilities	GAEPD Cost Guidance OP-9
WW-5. Develop and implement sewer system capacity, management, operation and maintenance (CMOM) program	$0-$1 million /MGD	State, Local, Utilities	GAEPD Cost Guidance WW-6
WW-6. Provide local government with acceptable parameters for septage disposal at facilities	$0-0.50 /capita	State, Local, Utilities	GAEPD Cost Guidance OP-9
WW-7. Implement grease management program	$0.10 - 2.25 /capita	State, Local, Utilities	GAEPD Cost Guidance E-2

Table 7-2: Cost Estimates for the Implementation Responsibilities			
WW-8. Implement flushable program	$0.10 - 2.25 /capita	State, Local, Utilities	GAEPD Cost Guidance E-2
WQ-1. Encourage comprehensive land use planning	$0-0.50 /capita	State, Local	GAEPD Cost Guidance OP-7 and OP-9
WQ-2. Encourage local government participation in construction erosion and sediment control	$1-3 /capita	State, Local	GAEPD Cost Guidance E-1
WQ-3. Encourage implementation of agricultural nutrient management programs	$5,000-7,000 /Farm	State	RCS, 2003
WQ-4. Encourage forestry best management practices	$5-100 /acre	State	Cubbage, F, J. Scott, T. Pressley, and S. Moore. Undated. *Costs of Forestry Best Management Practices in the South: A Review*. North Carolina State University. Department of Forestry. Costs vary by region, slope and practice.
WQ-5. Encourage effective stream buffer protection	$0-0.50 /capita	Local	GAEPD Cost Guidance OP-7
WQ-6. Encourage floodplain management / flood damage prevention	$0-0.50 /capita	Local	GAEPD Cost Guidance OP-7
WQ-7. Encourage general stormwater practices	$0-0.50 /capita	State, Local	GAEPD Cost Guidance OP-1
WQ-8. Support TMDL implementation	$0-2 /capita	Federal, State, Local, Utilities	GAEPD Cost Guidance for Education; assume would be similar level of effort and would vary depending on the complexity and cost of TMDL implementation

Table 7-2: Cost Estimates for the Implementation Responsibilities			
WQ-9. Promote post-development stormwater management	$0-0.50 /capita	State, Local	GAEPD Cost Guidance OP-1; cost to develop ordinance which would probably be similar to developing educational materials; costs do not include staff to review stormwater plans or any increased development costs
WQ-10. Monitor long-term ambient trends	$4,000-8,000 /site	State, Local	GAEPD Cost Guidance; assumes no metals monitoring; grab sample techniques
[1]GAEPD Cost Guidance, http//www.georgiawaterplanning.org/			

7.3 Alignment with Other Plans

As discussed in Section 6, a review of regional and local plans served as the basis for the development of the Region's selected management practices; a summary of the local and regional plans reviewed is provided in the supplemental document titled *Review and Summary of Existing Plans*, which is available on the Council website.[1] As a result, this update of the Regional Water Plan is generally aligned and consistent with these efforts; however, the following sections describe ongoing efforts and/or differences that are worth noting and revisiting during future Regional Water Plan updates.

7.3.1 Metro Water District Plans

The Metro Water District was created by the Georgia General Assembly in 2001 to establish policy, create plans, and promote intergovernmental coordination within the 15-County Metro Atlanta region, which includes more than 90 cities. The Metro Water District is therefore governed by a separate authorizing legislation than the Region, though the two are similar in some respects. For example, the Metro Water District is funded by State appropriations and per capita local government dues; it is governed by an elected/appointed Governing Board, which sets policy and direction. Metro Water District staffing is provided by the Atlanta Regional Commission Environmental Planning Division, while plans and policies are guided by the Board Executive and Finance Committees, the Technical Coordinating Committee, and the Basin Advisory Councils (Metro Water District, 2011).

Local governments and utilities are responsible for implementing the Regional Water Plans at the local level, and compliance with the plans is directly enforced through the GAEPD's permitting process. However, while this Regional Water Plan will guide GAEPD's future permitting decisions, local governments must be in compliance with the Metro Water District's plans to obtain a permit for an increased water withdrawal or a new or increased discharge, or to obtain an MS4 permit. GAEPD is responsible for auditing local governments to determine compliance with the plans, including audit checklists and site visits.

[1] http://www.upperoconee.org/pages/our_plan/index.php

In May 2009, the Metro Water District adopted comprehensive updates to the plans the District first adopted in 2003; these long-term water management plans address water supply and water conservation, wastewater management, and watershed management.

7.4 Recommendations to the State

This subsection describes the Council's recommendations to the State of Georgia for actions that will support the implementation of this Regional Water Plan. Table 7-3 summarizes these recommendations by type and reflects the role the Council envisions the State taking in support of the activities described in Section 7.1.

Table 7-3: Recommendations to the State

	Recommendation
Funding	Identify long-term funding mechanism, beyond grants, to assist responsible parties with implementation.
	Work with existing organizations such as the GSWCC to identify incentives to encourage the installation and use of variable rate irrigation systems by a certified irrigation professional.
	Identify funding assistance (grants or loans) for small community water systems that have had to shut down their groundwater supply wells and move onto surface water withdrawal and treatment systems based upon radionuclides levels of concern in groundwater. These systems fall within an area of the Upper Oconee Region that is known to have such levels of concern based on geologic conditions. Funding assistance may include grant or loan programs administered by DCA or GEFA, and may also include federal funding sources from USEPA or USDA.
Coordination	Coordinate with DCA and the RCs to serve as the clearing house and coordinator for ongoing Regional Water Plan planning activities.
	To provide continuity between Regional Water Plan updates, a minimum of six to nine members of the original Council should be re-appointed. Vacancies at each level should also be determined to assist when considering reappointments.
	The Council should meet a minimum of once a year (as directed by the Chairperson) to track implementation and address potential issues or questions regarding implementation or plan amendments. A Planning Contractor should be available to the Council to assist with coordination as well as implementation tracking or plan amendments. Invite regional utility directors to the annual Council Meetings.
	Work with existing organizations, such as ACCG, GMA and GAWP to develop templates and materials that each Regional Council, with the assistance of DCA or the RCs noted in Section 2.3, can adapt for regional / local implementation. Topic areas from Table 7-1 could include: public education program, water conservation goals, regional residential and commercial water audit program materials, golf course water management, grease management, CMOM, general stormwater management and stream buffer protection.
	Work with existing organizations such as the GSWCC, United States Department of Agriculture (USDA), and the State's University System to develop regional watering, nutrient management, cropland management guidelines for the major crops grown in the Region.

Table 7-3: Recommendations to the State (Continued)

	Recommendation
	Coordinate with State and local Public Health Departments to: • Develop consistent, minimum design standards that anticipate future centralized sewer connections where appropriate. • Develop example policies for connections to public sewer. • Develop regional recommendations and a model ordinance for decentralized sewer systems.
	Coordinate with GEMA on development of a model flood damage prevention ordinance.
Policy / Programmatic	Consider modifying (limiting) the extent of exemptions found in O.C.G.A. § 12-7-17 regarding the Erosion and Sedimentation Control Act. Increase enforcement capabilities for GSWCC as well as local erosion and sedimentation control acts.
	Revisit DO criteria for South Georgia, and the Region in particular, to consider naturally low background levels found in the Region.
	Build on existing GAEPD monitoring program to develop a regional long-term ambient trend monitoring network for the Region.
	Evaluate methodologies to shorten the timing for the permitting process on new reservoir systems.
Next 5-Year Update	Refine Resource Assessment models to allow presentation of results at a finer resolution.
	Collect and monitor withdrawal and discharge data from industries to refine the water balance and wastewater return ratio assumptions.
	Support the evaluation of the current in-stream flow policy to determine whether revisions are needed to protect aquatic resources.

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Section 8. Monitoring and Reporting Progress

Section Summary

Monitoring of the progress toward implementation of the recommendations will be based on key benchmarks for water conservation, water supply, wastewater, and water quality management practices.

Progress will be evaluated annually, biennially, or at each of the 5-year plan updates, depending on the management practice.

The selected management practices identified in Section 6 will be primarily implemented (as described in Section 7) by the various water users in the Region, including local governments and others with the capacity to develop water infrastructure and apply for the required permits, grants and loans.

The benchmarks prepared by the Council and listed in Table 8-1 will be used to assess the effectiveness of implementation and to identify changes that need to be addressed during the next 5-year Regional Water Plan update. As detailed below, the Council selected both qualitative and quantitative benchmarks that will be used to assess the extent to which the management practices are closing gaps and shortages over time and allowing the Region to meet its vision and goals.

8.1 Benchmarks

The State Water Plan guided the Council's selection of benchmarks that are specific, measurable, achievable, realistic, and time-phased. Table 8-1 outlines the benchmarks for implementing this Regional Water Plan; the short-term actions outlined in Table 7-1 will serve as overall benchmarks to be measured via an annual survey. While details on administration of the annual survey are pending Regional Water Plan adoption, it is assumed that GAEPD and DCA will coordinate this online measurement tool with the support of the RCs. GAEPD and DCA will track the results of these surveys for needed adaptation and Regional Water Plan adjustments during the 5-year update.

Table 8-1 also provides resource-specific benchmarks that allow a mechanism for tracking realistic and measureable progress in the long-term in addressing the water resource gaps, or issues, described in Section 5. For example, due to the time it takes to develop or expand water and wastewater infrastructure, it is appropriate to measure overall progress during the 5-year Regional Water Plan update cycle by revisiting the infrastructure shortages by County summarized in the tables in Section 5. The resource benchmarks also build on existing measurement tools, such as the biennial update of the Clean Water Act 305(b)/303(d) list of waters not meeting their designated uses.

Table 8-1: Benchmarks for Water Management Plans			
Category of Benchmark	**Benchmark**	**Measurement Tools**	**Time Period**
All Practices	Implementation of initial and short term actions	Annual Survey	Annual
Water Conservation (WC)			
Water Conservation (WC)	Maintenance or reduction of residential per capita water use	Update of Regional Water Plan per capita Water Use Estimates	Every 5 years
	Implementation of recommended Water Conservation Management Practices	Survey via Annual Water Conservation Plan Progress Report	Annual
Water Supply Practices (WS)			
Water Supply Practices (WS)	Improvement in water supply gap and maintenance of flow regime.	Resource Assessments	Every 5 years
	Reduction in future facility / infrastructure shortages between existing permitted water withdrawals (surface and groundwater) and future demands.	Update of Regional Water Plan Forecasts	Every 5 years
Wastewater Practices (WW)			
Wastewater Practices (WW)	Availability of permitted assimilative capacity in the major tributaries of the Region.	Resource Assessments	Every 5 years
	Reduction of the future wastewater facility shortages via expansions or development of new facilities to meet projected future wastewater demands.	Update of Regional Water Plan Forecasts	Every 5 years
Water Quality Practices (WQ)			
Water Quality Practices (WQ)	Support of designated use	305(b)/303(d) List of Waters	Biennial
	Reduction in pollutant loads observed in the watershed modeling.	Resource Assessments	Every 5 years
	Observed improvements in water quality monitoring results.	GAEPD Online Water Quality Database.[1]	Annual

[1] http://www.gaepd.org/Documents/EPDOnlineWaterQualityData.html

8.2 Plan Updates

Meeting current and future water needs will require periodic review and revision of Regional Water Plans. The State Water Plan and associated rules provide that each Regional Water Plan will be subject to review by the appropriate Regional Water Planning Council every 5 years and in accordance with guidance provided by the Director, unless otherwise required by the Director for earlier review. These reviews and updates will allow an opportunity for the Regional Water Plan to be adapted based on changed circumstances and new information that becomes available in the 5 years after GAEPD's adoption of these plans. These benchmarks will guide GAEPD during Regional Water Plan review.

8.3 Plan Amendments

This Regional Water Plan will be amended on a 5-year basis, as required, unless additional changes (triggering events) are identified in the interim period. Triggering events may include major droughts or significant water quality problems. Council Members may request a full meeting of the Council to address potential Regional Water Plan amendments in the interim period between Regional Water Plan updates by contacting the acting Council Chairperson.

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Section 9. Bibliography

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Appendix A – Summary of Edits and Updates 2016-2017 Review and Revisions

Section	Location	Change	Description
ES	Section Introduction	Updated	- The text was revised to reflect the purpose of this document as an update to the Plan completed in 2011.
ES	Section Process	Updated	- The text was revised to reflect detail on the meetings held during this Plan Update.
ES	Table ES-2	Updated	- The table was revised to reflect the updated resource assessment information.
ES	Section Water and Wastewater Demands	Updated	- The text was updated to reflect changes in other parts of the Plan.
ES	Figure ES-2	Updated	- The figure was updated to reflect the revised water forecasts.
ES	Figure ES-3	Updated	- The figure was updated to reflect the revised wastewater flow forecasts.
ES	Section Major Findings	Updated	- The text was revised to reflect the updated resource assessment information.
ES	Table ES-3	Updated	- Added Appendix A – Summary of Plan Updates
2	Introduction	Updated	- Population updated to 577,039 in 2015 from 579,873 in 2010
2	Section 2.2.1	Updated	- Population updated to 577,039 in 2015 from 579,873 in 2010 - Athens-Clarke County Population updated to 123,489 in 2015 from 117,500 in 2010
2	Section 2.2.2	Updated	- Total employment in the Region updated to 253,582 in 2015 from 243,768 in 2009 - The unemployment rate in the Region was updated to 5.8 percent in 2015 from 11.5 percent in 2009
2	Section 2.2.3 and Figure 2-3	Updated	- Text and Figure 2-3 updated to reflect more recent land use information
3	Section 3.1 including Figures 3-1 through 3-4	Updated	- Updated water use information to the most recent information compiled by USGS (2016 USGS Publication). - An update on Plant Branch was included.
3	Section 3.2	Modified text	- Written descriptions of the Resource Assessments were updated to more accurately describe the nature of the analysis. The summary of the modeling was also updated. Additional text was added to summarize the planning nodes.
3	Table 3-1	Added	- Values updated with most recent results of the assimilative capacity assessment.
3	Figure 3-5	Added	- Values updated with most recent results of the assimilative capacity assessment
3	Figure 3-6	Updated	- The figure was updated to include the Eden node, which is located outside the Upper Oconee region.
3	Table 3-2	Updated	- Table updated based on updates to EPD Rule 391-3-6-.03 Water Use Classifications and Water Quality Standards.
3	Section 3.3	Updated Impaired Water Bodies and Priority watersheds	- Percentage of impaired reaches was updated based on 2014 EPD assessment. - Text was updated regarding the State Wildlife Action Plan updated in 2015 impacting the priority watersheds.
3	Figure 3-7	Revised Figure	- The figure has been updated to show the types of impairments, and the surrounding text has also been updated, based on the 2014 303(d) list.
3	Figure 3-8	Revised Figure	- The figure has been updated to show the 2015 high priority watersheds per the State Wildlife Action Plan.
4	Table 4-1	Updated	- Population projections were updated based on the most recent statewide population projections from the Governor's Office of Planning and Budget.
4	Section 4.1.1	Text additions	- Text additions were added to describe updated methodology utilized during the Plan update.
4	Table 4-2 and Figure 4-1	Updated	- The table and figure were updated to reflect the revised municipal water forecasts. - Surrounding text was updated based on revised municipal water forecasts.
4	Section 4.1.2	Text removal	- Text additions were added to describe updated methodology utilized during the Plan update. - A contribution for I/I was not explicitly added under the revised methodology but instead forecasts were based on the reported discharges. Thus the paragraph describing I/I flows was removed.
4	Table 4-3 and Figure 4-2	Updated	- The table and figure were updated to reflect the revised municipal wastewater forecasts. - Surrounding text was updated based on revised municipal wastewater forecasts.
4	Figure 4-3	Updated	- The figure was updated to include 2015 data and include groundwater and surface water contributions.
4	Figure 4-4	Updated	- The figure was updated to include 2015 data. All other values remain unchanged.
4	Section 4.3	Text Updates	- The text was updated to reflect the updated methodology for forecasting agricultural demands that was updated in 2016.
4	Table 4-4	Updated	- This table was updated with the revised agricultural forecasts. - Values quoted in surrounding text were also updated based on current information.
4	Section 4.4	Text Updates	- The text was updated to reflect the updated energy forecast that was completed in 2016 and included some updates to the methodology.
4	Table 4-5	Added	- The table was added to provide details on the updated thermoelectric power water forecast. - There is no longer a regional portion of unassigned withdrawals as the Statewide unassigned withdrawals were significantly reduced since the previous round and this was no longer a factor.

4	Figure 4-5	Updated	- This figure was updated with the revised water demand totals per sector. - The figure was converted from pie charts to a bar chart to better show the trend of increasing demands. - Values quoted in surrounding text were also updated based on current information.
4	Figure 4-6	Updated	- This figure was updated to reflect the revised total water demand forecasts. - Values quoted in surrounding text were also updated based on current information.
4	Figure 4-7	Updated	- This figure was updated to reflect the revised total wastewater forecasts. - Values quoted in surrounding text were also updated based on current information.
4	Former Figure 4-8	Removed	- This figure was removed in the Plan update.
5	Former Figure 5-1	Removed	- This figure was removed in the Plan update. Similar figures are available in the groundwater assessment material.
5	Former Table 5-1	Removed	- This table was removed in the Plan update. A figure with this information is still included for the Floridan aquifer and text description for the Cretaceous aquifer was added.
5	Figure 5-1	Revised Figure	- Former Figure 5-2 was revised to include the update demand forecasts. - The revised figure shows only the 2015 and 2050 demands to simplify. -Only the 75th percentile Agricultural demands are shown to simplify. -The figure now shows what portion of the demand is from the Upper Oconee area compared to other Council areas.
5	Figure 5-2	Revised Figure	- Former Figure 5-3 was updated to a consistent format as that used in other Council Plans. The planning nodes are shown in the updated figure, as well as their drainage areas.
5	Table 5-1	Updated	- This table previously included results for the Penfield node. That node no longer has a potential gap in the surface water analysis. However, Eden node is now included in the table since it has an identified potential gap and a portion of its drainage area is in the Upper Oconee Region.
5	Table 5-2	Added	- This table was added to provide additional detail regarding the frequency and duration of potential gaps. This information was utilized in determining the most relevant management practices for addressing the potential gaps.
5	Table 5-3	Added	- This table was added to provide details regarding the additional surface water use forecasted to occur within the drainage area to the Eden node.
5	Table 5-4	Added	- This table was previously included in other Councils and was added here to show how surface water demand is forecasted to grow or decline in potential gap areas.
5	Table 5-5	Updated	- Former Table 5-4 was updated with the latest permitted water withdrawal values and the updated demand forecasts. There are now fewer counties with a projected need for additional future permitted water withdrawal capacity, most likely due to lower demand estimates based on the updated population projections.
5	Table 5-6	Added	- This table was previously included in other Council Plans and was added here to summarize the updated assimilative capacity results under current permitted conditions.
5	Figure 5-3 and Figure 5-4	New figure format developed	- New figures were development showing the assimilative capacity results across the whole planning council instead of the previous versions, which pieced together portions of the different drainage basins.
5	Figure 5-5	Updated	- This figure was updated based on the revised analysis.
5	Former Figure 5-6 and Figure 5-7	Removed	- The data to update these figures was not readily available. Maps of the nutrient loading by drainage basin are available in the resource assessment documentation.
5	Figure 5-6	Added	- This figure was added to provide information on modeled Chlorophyll-a concentrations in Lake Sinclair, similar to what is provided in Figure 5-5 for Lake Oconee.
5	Table 5-7	Updated	- Former Table 5-5 was updated with the latest permitted discharge flow values and the updated wastewater flow forecasts - The table is now split between point source discharges and land application systems.
5	Table 5-8	Updated	- Former Table 5-6, and associated text, were revised to reflect the updated resource assessment information.
6	Section 6.2	Text additions	- Subcommittee created to update original 2011 Regional Water Plan management practices
6	Table 6-1a	Updated text of Management Practices	WC-1 – Encourage conservation pricing The language was modified to remove "eliminating declining block rate structures" from this management practice. WC-2 – Develop water conservation goals The word choice and sentence structure was revised in this management practice. WC-3 – Consistently meter and report agricultural water withdrawals This management practice was deleted. Former WC-4 – Implement education and public awareness programs The wording the in management practice was changed from “implement” to “encourage”. Former WC-5 – Implement golf course water management education program This management practice was deleted.

			Former WC-6 – Encourage variable rate agricultural irrigation systems The watering requirement and soil identification previously mandated under this management practice was deleted. Former WC-7 – Encourage non-potable reuse This management practice was modified to include “when and where feasible.” Former WC-8 – Require installation of rain sensor shut off switches on new irrigation systems The wording in this management practice was changed from “require” to “encourage”, and also to include all irrigation systems as well as to develop educational materials to encourage retrofitting of rain sensors. Former WC-9 – Require new car washes to recycle water The wording in this management practice was changed from “require” to “encourage”, and include all car wash establishments regardless of size and scale.
6	Table 6-1b	Updated text of Management Practices	WS-2 – Construct new water supply reservoirs The management practice was modified to require a financial feasibility study as a part of new water supply reservoir assessment.
6	Table 6-1c	Updated text of Management Practices	WW-4 – Develop septic system planning and management policies and guidance The management practice was modified to create a septic system map and require septic tank certification program as part of the homebuyer closing process. WW-8 – Implement “Do Not Flush” management program The management practice was added to prevent SSOs.
6	Table 6-1d	Updated text of Management Practices	WQ-2 – Encourage local government participation in construction erosion and sediment control The management practice was modified to delete implementation of practices to reduce runoff from construction sites and the need to develop compliance monitoring and enforcement procedures for existing programs. WQ-3 – Encourage implementation of agricultural nutrient management programs The management practice was modified to utilize educational materials from several agencies. WQ-5 – Encourage stream buffer protection The management practice was modified to change the focus for this management practice towards implementing existing buffer requirements. . WQ-6 – Evaluate water quality credit trading This management practice was deleted. Former WQ-7 – Encourage floodplain management / flood damage prevention The management practice was modified to remove the word “prohibit” from the description. Former WQ-8 – Encourage general stormwater practices The management practice was modified to implement post-development stormwater controls to decrease runoff velocity and promote infiltration. Former WQ-10 – Encourage agricultural cropland management practices The management practice was modified to encourage the use of crop management practices in the Soil and Water Conservation Commission Best Management Practices for Georgia Agricultural Manual. Former WQ-11 – Promote post development stormwater management This management practice was deleted.
7	Table 7-1 (all)	Reformatted	- The table deleted column labelled "Initial Implementation Step(s) 2011-2012," and appropriate initial action items were shifted into the "Short-Term Actions" column.
7	Table 7-3	Updated text of Recommendations to the State	Funding An additional recommendation was added: Identify funding assistance (grants or loans) for small community water systems that have had to shut down their groundwater supply wells and move onto surface water withdrawal and treatment systems based upon radionuclides level of concern in groundwater. Coordination The following changes were completed: - To meet a minimum of once a year as directed by the Chairman. - To have a Planning Contractor be available to the Council to assist with coordination as well as implementation tracking or plan amendments. - To invite regional utility directors to the annual Council Meetings. Policy/Programmatic

			The following recommendations were deleted: - Develop and implement a consistent program to meter and report agricultural water withdrawals greater than 100,000 gallons per day. - Develop regulatory framework and guidelines for water quality credit trading in Georgia. The following recommendation was added: - Increase enforcement capabilities for GSWCC as well as local erosion and sedimentation control acts. Next 5-year Update The following recommendation was deleted: - Conduct further study on the Cretaceous aquifer in Washington, Wilkinson, and Laurens Counties to clarify sustainable yields. The recommendation to collect and monitor withdrawal and discharge data from kaolin industry was modified to include all industries.
General updates completed throughout the plan		Updated references to "Upper Floridan" aquifer to read "Floridan" aquifer.	References to the "Upper Floridan" aquifer were updated to read "Floridan," to ensure consistency with terminology used by EPD in the 2013 Announcement regarding Future Withdrawals from the Floridan Aquifer and in other documents.
		Removed references to the current State Water Plan or Council webpages (instead referring to availability on the Council's website of the Water Planning website).	- EPD is currently working to build a new Regional Water Planning website. Once the new site is up, the former site will be taken down. Web links in the Regional Water Plan document will be updated once the new website is completed.

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